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ARMOURERS' INSTRUCTIONS 1885

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INSTRUCTIONS

FOR THE

ARMOURERS

OF

HER MAJESTY'S FLEET.

BY AUTHORITY OF THE LORDS COMMISSIONERS OF THE ADMIRALTY.

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CHAPTER I.

ENTRY, INSTRUCTION, AND EXAMINATION.

For Rating of Armourer's Crew.

Regulations for the entry of armourer's crew will be found at p. 108 of the Admiralty Instructions.

The examination is to be as follows:

Examination for armourer's crew.

(*a.*) To make stud for sword bayonet and lower swivel screw for rifles (parts most likely to be broken).

(*b.*) To make a breech pin (revolver).

(*c.*) To show aptitude generally, and be able to do light work at the forge.

Men possessing the above qualifications will then go through the under-mentioned course in one of the gunnery ships.

Rifle } Manipulation and } Pistol } necessary repairs of	- -	20 days.
	- - -	10 „
Guns, slides, and carriages	- - -	20 „
Hydraulic buffers and jacks	- - -	10 „
Gatling and other machine guns used in the sea service	- - - -	10 „
Electric firing gear—Making junctions, putting on gun points, &c., soldering, care and repair of firing keys	- - - -	2 „
Total	- - -	72 „

Note.—Any man showing marked proficiency in any of these subjects need not necessarily remain the entire number of days mentioned above.

Examining officers.

At the conclusion of this course they will be examined in these subjects by a lieutenant, the gunner, and the

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armourer of the ship (under the direction of the captain), in order that ships, only allowed an armourer's crew, may have a competent man for the necessary care and repair of arms, &c.

For Rating of Armourer's Mate.

Gunnery Examination.

(*a.*) To be able to assemble the various parts of Martini-Henry rifle and Enfield pistol. To solder on a backsight and make a striker or extractor for a rifle, or a pawl lever for a pistol.

(*b.*) To be able to assemble the various parts of all service machine guns and make a firing pin for a Nordenfelt.

(*c.*) To be able to assemble the various parts of all service carriages and slides, and to show a thorough knowledge of the management of hydraulic jacks.

Candidates will be examined by a staff lieutenant, gunner, and armourer of the gunnery ship. Provisional examination abroad may be carried out as laid down at page 4.

To enable a man to pass for an armourer's mate, it is necessary he should pass through a torpedo school.

The torpedo course lasts twenty days, and embraces the following subjects:—

1. Electricity and Torpedoes:—

Understand the torpedo stores and explosives supplied to ships.

To be able to take to pieces, put together, adjust, and test the following:—

Pistol for instantaneous fuze. Galvanometers, single needle and astatic. Detectors. Firing keys. Test coil. Firing resistance coil. Circuit closers. Circuit breakers, electric bells, and divers' telephone. Charge, test, and do small repairs to electrical batteries.

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Refit washers and insulating plugs to naval mines, and disconnectors.

Prepare ends of torpedo poles and boats' outrigger fittings, and fit outrigger charges.

Refit and test drill tubes.

Test and solder detonators. Fit naval mines complete for service and exercise, also hand-charges.

Make junctions in service electric cables.

Fit, repair, test, and mark the various electric circuits under supervision.

2. Electric Light :—

Test machines and circuits.

Test lamps and projectors.

Test machines for polarity.

Adjust brushes of machines (care required).

Trace circuits of E. L. machine.

3. Whitehead :—

To have a general knowledge of the principle and pattern of Whitehead torpedoes used in the service.

To have a thorough knowledge of the heads, charges, and pistols, and all external adjustments for exercise and service.

To explain the use of fittings for ships' and boats' discharging apparatus used for Royal Laboratory and Fiume pattern torpedoes, also charging and separator columns and reservoir.

To be able to block propellers, test Whitehead directors, refit impulse tubes, and test gauges.

To explain the use of Whitehead tools on the gunners' charge.

Candidates will be examined, at the conclusion of the torpedo exercise, by officers of the torpedo school, and will be required to obtain 65 per cent. of full marks to pass.

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For Rating of Armourer.

Examination for armourer.

The examination for armourer is to be as follows:—

(*a.*) To be thoroughly acquainted with the method of manipulating the Martini-Henry (or other) rifle, Gatling or other machine guns, pistol, or other small arms as issued for sea service, and in making minor repairs.

(*b.*) To be capable of taking apart or connecting all parts of guns (including the breech fittings of B.L. guns), carriages, and slides, to execute any light repairs needed, to fix sights, &c., and to have an intimate acquaintance with the spare gun-gear of different patterns.

(*c.*) To be acquainted with the management of hydraulic jacks, their cleaning and repair; also hydraulic buffers, and the care necessary to be taken in filling them, &c.

(*d.*) To be able to take impressions of the bores and vents of guns, and to be able to assist a qualified officer in re-venting heavy guns, re-bushing B.L. guns, and re-facing the vent pieces.

Candidates will be examined by a lieutenant, gunner, and the armourer of the gunnery ship.

To enable a man to pass for an armourer, it is necessary he should pass through a torpedo school. The torpedo course lasts for twenty days, and embraces the same subjects as that for armourer's mate.

Candidates will be examined, at the conclusion of the torpedo course, by officers of the torpedo school, and will be required to obtain 75 per cent. of full marks, and at least 70 per cent. of the numbers given for each individual subject to pass.

Provisional examination abroad.

Armourer's crew abroad desirous of passing for armourer or armourer's mate are to be examined provisionally by a gunnery lieutenant and a torpedo lieutenant, if available, a gunner, and an armourer, but the final examination will always be carried out on board the gunnery and torpedo ships.

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The senior armourers of the gunnery ship on first appointment are to attend Woolwich and Enfield as follows:— Armourers of gunnery ships.

Gun Factory - - -	10 days.
Carriage Department - -	10 „
Small Arm Factory - -	42 „

After this first course they are to attend once every year for half the period above mentioned.

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CHAPTER II.

MACHINE GUNS.

Instructions for the Care, Preservation, and Examination of Machine Guns.

1. The barrels of all machine guns on board ship, or in situations where they are exposed to a moist atmosphere, will be examined and wiped inside and outside with an oiled rag daily. It is most important that the chambers be kept thoroughly clean and free from scratches.

2. In other cases this will be done as frequently as circumstances may require, according to the discretion of the officer in charge of the guns.

3. The locks of all Gatling guns will be taken out and oiled monthly.

4. When guns are returned to store, packed for transmission, or stowed away in any place where they cannot be readily examined, the barrels and unpainted parts should be coated with the following mixture:—

Beeswax - -	4 lbs.
Paraffin - - - -	4 „
Chalk - - -	2 „
Oil, Rangoon - - -	6 quarts.

The mixture is to be made hot and a piece of flannel dipped in it, with which the exterior parts will be dabbed.

To coat the inside of barrels, draw a bunch of lamp cotton, well saturated with the mixture, through from both ends; the lamp cotton is to be attached to a piece of twisted copper wire.

5. As all Gardner tangent sights with the sliding stem and some Nordenfelt tangent sights have the figures and graduations filled in with tin, they must on no account be coloured by heat, but are to be browned according to instructions for browning barrels (Chap. II.), care being taken not to disturb the tin during scratching.

6. The following course will be pursued after practice with machine guns:—

(*a.*) Hoppers, drums, feeders, and barrel chambers, should be examined to see that there are no live cartridges left in.

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(*b.*) With Gatling and Gardner guns.—The locks will be taken out; the extractors, firing-pins, hammers, springs, and butts will be examined, to ascertain that they are not broken. It will not be necessary to strip the locks for this.

(*c.*) With Nordenfelt guns.—The action-block will be taken off, and the extractors, firing-pins, spiral springs, and hammers examined.

7. Should any hitch occur during practice, such as miss-fires or jams, the gun will be examined at once for the purpose of ascertaining the cause, and then adjusted.

8. Every machine gun will be thoroughly stripped and examined every six months, and the result of this examination will be shown in the "Memorandum of Examination," referred to in Clause 37, Army Circulars, 1880.

GUNS.—NORDENFELT 1-INCH, 4-BARREL, MARKS I., II., AND III.

MARK I. guns are all numbered below 1,000. The spare parts are not interchangeable, so must be kept to the gun with which they are issued. The guns are not interchangeable in the mountings.

MARK II. guns are all numbered between 2,000 and 2,600; the left trunnion is stamped II. The spare parts are interchangeable, but the spare cocking piece may require some slight adjustment.

MARK III. guns commence at No. 3,000. The spare parts are interchangeable. III. is stamped on the left trunnion, the spare parts that are special to Mark III. or that will not interchange with Mark II. are stamped III.

The fore-sights of Mark II. and III. guns are interchangeable as regards dovetail, but in fitting a spare sight the height must be obtained from the original one, and the centre struck from the line on the front cross-piece.

Armourers should make themselves thoroughly acquainted with the different Mark guns.

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Nomenclature.*

Action Block -	Action cam plate, screws (1) for do., *keeper* (2) *screws for do.;* breech plugs, *set screws for do.; cocking arrangement consisting of pivot block, fixing screws for do.* (3), *pin for do., spring for do., screw for do.;* extractors, screws for do., *springs for do.;* firing pins; friction roller with collar, pin, and stud; hammers; locking bolts, *guide screws for do.;* locking bolt plate, pivot (4) screw, *stud, keeper* (5) *screw, split pin and washer for do.; shield, screws for do.;* spring bar, pivot, *centre* and thumb screws for do.; spiral springs for locks.
Action Lever -	Axis pin, taper and split pin for do.; friction roller with stud and cross-pin.
Barrels.	
Cartridge Carrier	*Catch for do. with screws;* lever.
Centre Cross-piece	Fixing screws; cover lock with *catch,* fixing screw, *guide screw, spiral spring, stop* (6) *screws and thumb-piece.*
Cover - -	Hopper catch with screw; pivot screws.
Fore-sights -	Fixing screws.
Frame - -	Cotters; cover catch (7) with screw; hand-lever catch and screw; *under plate with screws.*
Front Cross-piece	Bolts and nuts for do.

---

* The parts in italics are not in Mark III. guns.
(1.) 6 in Mark I. and II., 1 in Mark III. guns.
(2.) In Mark II. guns only.
(3.) In some Mark II. guns the pivot block is solid with the action block.
(4.) In Mark III. guns only.
(5.) Not in all Mark I. guns.
(6.) „ „ Mark II. „
(7.) „ „ „ I. „

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HAND-LEVER.

HOPPER - -	Slide; stop screw.
REAR CROSS-PIECE -	*Bracket for axis pin, screws* (8) *for do.;* drill stop with catch, handle; lever, milled head, spiral spring and taper pins; number plate with screws; *tumbler; tumbler spring and screws;* trigger (4) comb spring.
TANGENT SIGHTS -	Brackets; fixing screws; hand wheels; pinions; set screws; split pins; springs; spring washers; stop rings; taper pins.

TRIGGER COMB.

MOUNTING.

CONE - -	Pivot, screws and nuts (7) for do.; pivot bolt with nuts and washer; worm ring, steady pins for do.
CROSS-HEAD -	Cap squares, keys with chains and studs; screws.
ELEVATING GEAR, consisting of.	Brake complete with milled head, taper pin for do., set screw, shoe spiral spring, strap and fixing screw for do.; gun-metal nut; hand wheel; inner screw; outer screw; pin; pivot screws with nuts.
TRAVERSING GEAR, consisting of.	Hand-wheel with key; spindle, collar and split pin for do.; worm.

TO MOUNT GUN WHEN RECEIVED FROM STORE.

(1.) Take nut and washer off pivot bolt, mount gun and cross-head on pivot, replace washer and nut, and screw hard down to shoulder.

(2.) Turn elevating hand wheel until its boss rests upon the gun-metal nut; turn inner elevating screw until an arrow-head, which will be found on the thread, coincides with a similar arrow-head on the top end of outer screw;

(8.) 2 in Mark I. and 3 in Mark II. guns.

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swing elevating gear in the bracket designed for it, keeping the head of brake screw to the rear; tighten up pivot screws, so that there is no shake in nut, and fix with check nuts. Put elevating pin through eye of inner screw, and screw into frame, hard up to shoulder.

(3.) Take collar and worm off traversing spindle, place worm in bracket, featherway upwards, and the arrow-head to the rear; pass the spindle through to position; put on collar and drive in split taper pin.

(4.) Drive split and taper pins out of axis pin; put on hand-lever and replace pins.

Directions to be observed at Periodical Examinations.

N.B.—Care must be taken never to remove the following parts, unless absolutely necessary:—Barrels, breech plugs, cross-pieces, action cam, front-sights, tangent sight brackets.

To Strip Gun.*

(1.) Take out cover pivot screws, and remove cover; draw back hand-lever until the extractors are well clear of the cartridge carrier; *turn back cartridge carrier lever catch*, and remove cartridge carrier by lifting it straight up until clear of the gun.

(2.) Push forward the hand lever until the extractors are within $1\frac{1}{2}$ inches of the barrels; let two men remove the action block, each man taking hold of one breech plug and the rear end of action block, and lifting it clear of gun.

(3.) Lift out trigger comb; *turn the tumbler until the feather and feather-way coincide, then lift it off.*

(4.) Drive split and taper pins out of axis pin, and drive off hand-lever; lift out action and cartridge carrier levers.

(5.) Strip action block. Release thumb screw and turn back spring bar; remove spiral springs and hammers; the extractors may be taken out *by forcing the extractor back*

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slightly, and passing a brass wire between the extractor spring and brecch plug; this will relieve the pressure from extractor, which may be withdrawn after taking screws out (*whilst the extractor is out, draw the brass wire forward nearly to point of spring, it can be pushed back when the extractor is to go in again*); push firing pins out with brass wire; *drive split pin out of stud, and lift off washer and locking bolt plate; push locking bolts as far out as they will go, and turn out guide screws, remove locking bolts;* drive pin out of stud, and remove collar and friction roller; *remove cocking arrangement.*

To remove the locking bolts in Mark III. guns the fixing screw of the action cam plate must first be taken out, then, having turned out the pivot screw, the locking bolt plate can be lifted off and the locking bolts withdrawn.

To Clean Gun.

Each part must be thoroughly cleaned before assembling; turpentine or oil only will be used for this purpose; emery cloth or any cutting substance must on no account be used.

To Assemble Gun.*

(1.) *Replace cocking arrangement;* put on friction roller and collar, and drive in pin; put in locking bolts *and screw in guide screws hard enough on shoulder to permit the locking bolts to work freely;* put on locking bolt plate *and washer, drive in split pin, and open out ends.* In Mark III. guns put in pivot screw and cam fixing screw.

(2.) Put in firing pins, extractors, hammers, and spiral springs; turn spring bar, and fix with thumb screw; *see that all the screws in action cam are well home.*

(3.) Pass the axis pin through hole in cartridge carrier lever, then through axis bracket; put on hand lever, and drive in taper and split pins.

(4.) Place *tumbler and* trigger comb in position, *letting the curved end of tumbler go into recess in trigger comb, whilst the other arm of the tumbler runs to the right, and receives pressure from the tumbler spring.* In Mark III.

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guns the end of the trigger comb spring works in the recess, thus doing away with the tumbler.

(5.) Place action block in frame, at the same time working friction roller into cam.

(6.) Draw back hand lever to nearly the end of stroke, and put cartridge carrier in place.

Fasten cartridge carrier lever catch.

(7.) Fix cover; see that all nuts and screws on gun are well home.

To Clean Gun at other Times than at Periodical Examinations.*

(1.) Proceed as far as paragraph 3 "to strip gun," then clean and oil levers, letting them remain in gun; see friction roller on action lever revolves; oil roller.

(2.) Take spiral springs, hammers, extractors, and firing pins from action block; clean hammer channels, and holes through breech plugs; try hammers and firing pins in their places, where they should be so free that if the action block be lifted they would fall out.

(3.) Oil friction roller, and see that it turns on stud; it need not be taken off to do this; *clean cocking piece.*

(4.) Take off locking bolt plate, and draw the locking bolts *as far through as they will come without shifting the guide screws*, clean and oil, put together, and see that it works freely.

(5.) Replace firing pins, hammers, spiral springs, and extractors, oiling each part. The slot in the extractor in Marks I. and II. guns is for the purpose of allowing the extractor spring to throw a little weight on to the firing pin. This is accomplished in Mark III. guns by the lug on the tail end of extractor bearing on the firing pin. When the firing pin projects beyond the face of breech plug, it should require a pressure not exceeding 5 lbs. to push it back, or not more than 3 lbs. when the spiral springs are out. The hook end of the extractor should require a pull of 8 to 12 lbs. to lift it off the breech plug.

(6.) Clean and oil trigger comb rests, *tumbler* and trigger comb; see that trigger comb works perfectly free

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before putting in *tumbler*, or in Mark III. guns the trigger comb spring, *when tumbler is in*, the trigger comb should require a pull of 12 to 14 lbs. to bring it over to the right-hand side of frame.

(7.) Clean and oil cartridge carrier, and see that it works freely to and fro before the action block is in.

(8.) See that cartridge chambers, extractor slots, and cartridge head recesses are perfectly clean.

(9.) Oil action cam and slides of action block, and assemble gun.

(10.) Use rangoon oil, little and often; this will prevent it getting thick and clogging the mechanism.

To Remove Breech Plugs, Barrels, &c., when absolutely necessary.*

Breech Plugs.—To remove breech plugs *in case of a broken extractor spring.* Having *first* removed the extractor, *release the set screw,* and unscrew the breech plug with the special spanner; *place new extractor spring in position, and* screw in breech plug (*taking care that the spring is not displaced by the edge of recess*), until a line cut upon breech plug coincides with a similar line on face of action block, *fix set screws.*

To remove the Barrels. — Take out the bolts in the front cross-piece, slip the front cross-piece forward off the muzzles of the barrels; *release the set screw underneath the breech end of the barrels,* and, first taking care that the extractors are clear of the extractor slots, screw out the barrels with the large spanner.

To remove the Rear Cross-Piece. — Dismount the mechanism; drive out the cotters, and pull out to the rear.

To remove the Centre Cross-Piece.—Dismount the mechanism; remove the barrels and the rear cross-piece; take out fixing screws; push the rear ends of the frame outwards with the knees until the centre cross-piece can be taken out of its sockets, then pull it out to the rear.

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Before Working Gun.*

1. As the following parts can be got at by merely removing the cartridge carrier and action block, they should be oiled before using the gun.

2. Raise the cover; take out cartridge carrier, and, having brought breech plugs up to within two inches of barrels, lift out action block and pass forward.

3. Oil locking bolts, *guide screws*, and plate; action lever, point, tail, and roller; *cocking piece;* cartridge carrier lever, point, axis and roller slide; trigger comb; rests, studs, and cam; *tumbler;* extractors; hammers; axis pin; edges, and inside of frame, where action block slides.

4. Whilst action block is out, try extractor with thumb, and see that all the firing pins can be pushed back with the thumb nail; draw hammers down with the loop on brass wire drift, and see that they spring back freely; *see cocking-piece works freely.*

5. See that taper pin in hand lever is driven well home

6. Cock gun, and see that all four locks snap properly.

Management of Hopper.*

1. To fill hopper.—Invert the hopper and withdraw the slide; place 10 cartridges in each of the four columns designed for them; close slide.

2. *Turn back hopper catch,* slide on hopper, keeping the arrow to the rear; *re-fasten catch.*

N.B.—Hoppers should be examined frequently to see that the slide works freely.

General Instructions.

When firing, let hand lever be carried backward and forward to its *full* extent, *decreasing* the speed at both ends of the stroke; *i.e.,* when cocking and firing.

Miss-fires.—Should miss-fires occur, the probable cause will be weak spiral spring, hole in breech plug, or action block dirty, groove for hammer head burred, firing pin rusty, or too much pressure thrown on neck of firing pin by extractor *spring.*

---

* The parts in *Italics* refer to Mark I. and II. guns only.

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Non-extraction may be caused by the extractor spring being weak; hook of extractor worn to an obtuse angle, or extractor slot in barrel being dirty.

Proportion of Spare Parts and Tools.

SPECIES.	To each Gun in Ships with 1 or 2 Guns only.	To each Gun in Ships with more than 2 Guns.	To each Mark I. Gun.*
Parts.			
†Cocking piece	1	1	1
Extractors	12	8	8
Hammers	6	4	3
Hoppers, complete	7	7	7
Pins, firing	12	8	8
Screws, extractor	4	4	4
† „ cocking arrangement	1	1	1
Sights, fore, with fixing screw { right	1	1	1
Sights, fore, with fixing screw { left	1	1	1
„ tangent, with split pin, spare	2	2	2
†Springs, extractor	6	4	2
† „ cocking arrangement	1	1	1
„ sight, tangent	2	2	2
„ drill stop handle	2	2	4
„ spiral, for lock	12	8	8
„ „ brake	2	2	4
„ tumbler	2	2	2
‡ „ trigger comb	2	2	—
Tools.			
Cans, oil	1		
Drifts, brass wire	4		
Drivers, screw	1		
„ „ for extractor screw	1	1 set for every 4 or less number of guns.	
Punches, pin, of traversing spindle	1		
Rods, cleaning	4		
Spanners { large	1		
Spanners { small	1		

* With the exception of the hoppers, these parts are carried in a mahogany box supplied with the gun.

† For Mark I. and II. guns only.

‡ „ III. guns only.

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Instructions for fitting Parts necessary to assimilate the Method of Securing Hoppers on Mark I. and Mark II. Nordenfelt Guns to Mark III.

Block and Hopper-catch.

Fig. 1.
End view.

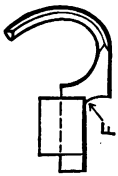


Fig. 2.
Plan of underside.

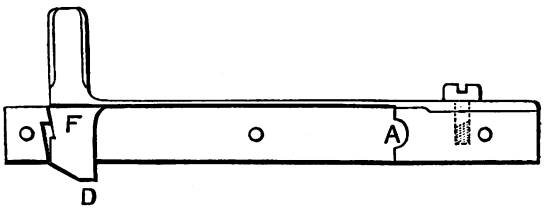


Fig. 3.
Plan of hopper-strip drilled and filed.

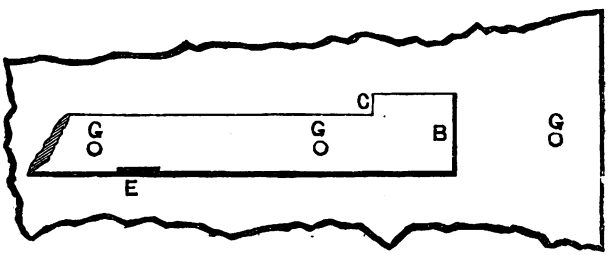
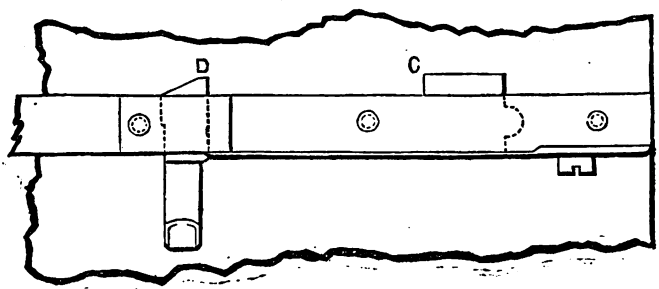


Fig. 4.
Plan showing block and catch in position.



Right-hand edge of gun.

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Parts issued :—

Hopper-catch - - - -	1
„ „ screw - - -	1
„ „ block - - -	1
Rivets (one long and two short) - -	3
Gauge (to each vessel) - - -	1

Figures 1 and 2 show the block and hopper-catch as issued.

Figure 3 shows the hopper-strip drilled and filed ready to receive the new block and catch.

Figure 4 shows the new hopper-catch in position.

Take off the old hopper-catch. With a file round off the rear top edge of the hopper-strip at (E, Fig. 3) to suit the curve (F, Figs. 1 and 2) at junction of nose and spring of hopper-catch. This will allow the catch to lie flat against the hopper-strip when the block is held in position.

Place the new catch and block upon the hopper-strip, bringing the shoulder (A, Fig. 2) up against the end of the hopper-strip (B, Fig. 3), try the gauge between the stop (C, Fig. 4) on the hopper-strip and the projecting nose (D) on the hopper-catch; if the gauge will not go between, take the catch off the block and file away the shoulder (A, Fig. 2), which is hollowed out to simplify this operation; screw on the catch and again try the gauge, repeating the operation until the gauge just goes in freely.

Carefully mark off the position of the holes; drill through the hopper-strip and cover three holes (G, Fig. 3) the same size as the holes in the block; countersink the holes on underside of cover and rivet the block on; file the rivet-heads off flush.

As Mark III. hoppers may sometimes be issued for Mark I. and Mark II. guns, all Mark I. and Mark II. guns are to be altered to take Mark III. hoppers. This alteration will enable any gun to take any hopper, and the following

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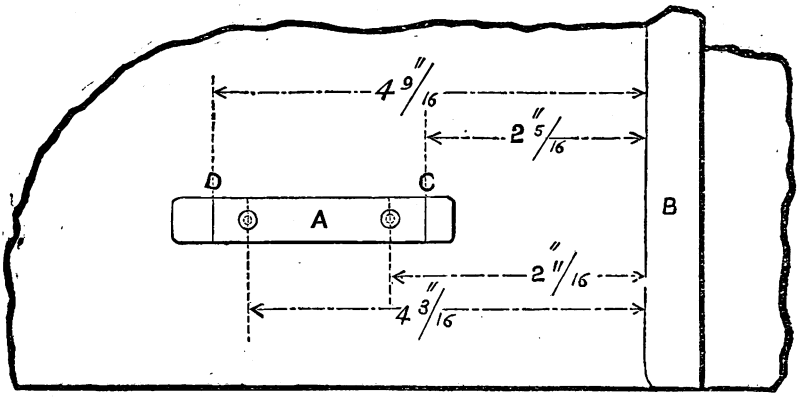
are the instructions for armourers for altering Mark I. and Mark II. guns to take Mark III. hoppers :—

To alter guns to take Mark III. hopper.

HOPPER-SLIDE STOP.

FIG. 5.

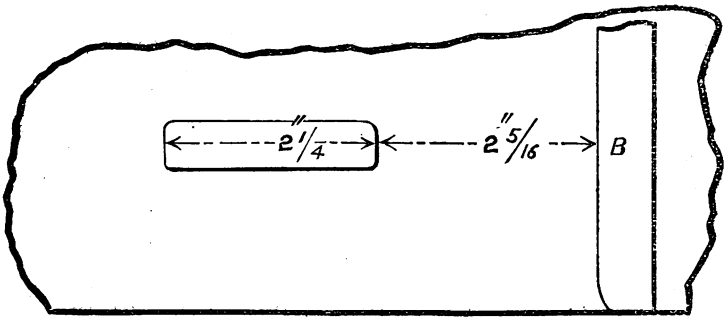
Plan of existing hopper-slide stop.



Left-hand edge of gun.

FIG. 6.

Plan of altered hopper-slide stop.



Parts issued :—

One length of iron wire to form rivets.

Clean the hopper-slide stop (A, Fig. V.) with emery cloth until the position of the three rivets can be seen.

Scribe two lines (C and D, Fig. V.) across the stop, $2\frac{5}{16}$" and $4\frac{9}{16}$" from the hopper-strip (B), this will enclose a length of stop of $2\frac{1}{4}$"; if the three rivets be *within* this

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length, file through the stop at the lines with a half-round file, and clear away the ends, leaving the stop as shown at Fig. 6.

Should the rivets be found to fall outside the lines, $\frac{3}{16}$" holes are to be drilled through the stop and cover at positions indicated in Fig. 5. These holes are to be countersunk at both sides, and fitted with rivets made from the wire issued; afterwards file away the ends of the stop, and use the old rivets to fill the exposed holes.

Care must be taken, in filing the rivet-heads flush, not to reduce the height of the stop.

GUN, NORDENFELT, 1-INCH, 2-BARREL, MARK I.

NOMENCLATURE.

Action Block.—Trigger comb; trigger-comb spring; hammers; lock springs; spring bar.

Action Lever.—Friction roller; stud and fixing pin.

Barrels.

Breech-block.—Extractors; extractor screws; firing pins.

Cartridge Carrier.—Guide pin.

Cover.—Joint screw; cover lock, consisting of spindle, handle, and fixing pin; hopper catch.

Foresight.—Fixing screw.

Front Cross-piece.

Frame.—Cotters; number plate and screws; chain and stud for fixing hand lever.

Hand Lever.

Hopper.—Slide; stop-screw.

Tangent Sight.—Pinion; fixing-screw for do.; split-pin; spring.

MOUNTING.

Cone.—Pivot-bolt; nut; set-screw.

Cross-head.—Cap-squares, with keys, screws, chains, and studs.

Elevating Gear.—Consisting of nut; pin; outer screw; inner screw; hand wheel; collar and taper-pin; brake

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complete with strap; fixing screw, shoe, spiral spring, set screw, milled head and pin.

Traversing Gear.—Consisting of worm; worm spindle; collar and taper pin; hand wheel and taper pin.

INSTRUCTIONS FOR STRIPPING AND ASSEMBLING GUN.

Stripping.—Open the cover and push the hand lever forward; lift out the action block.

Draw back the hand lever and lift out the cartridge carrier and breech-block.

Lift out the action lever.

To strip Action Block.—Push down the spring-bar and draw out the springs and hammers; drive out the trigger-comb spring and take out the trigger-comb.

The firing pins may be pushed out of the breech-block with the brass wire-drift.

Assembling.—Reverse the above operations.

The following tools and spare parts are issued with each gun:—

SPARE PARTS.

Extractors	2
Hammers	1
Firing pins	2
Screws, extractor	4
Sights, fore, with screw	1
„ tangent, with split pin	1
Springs, spiral, for lock	4
„ sight, tangent	2
„ trigger-comb	2

TOOLS.

Cans, oil	1
Drifts, brass wire	1
Drivers, screw	1
„ „ for extractor screw	1
Punches, pin, of traversing spindle	1
Rods, cleaning	1
Spanners	1

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GUNS, NORDENFELT, 0·45-INCH, 5-BARREL, MARK I.

NOMENCLATURE.

Action Block.—Breech plugs with set screws; extractors with fixing screws; firing pins; hammers; spiral springs; spring bar with pivot and thumb screws.

Action Lever.—Stud; cross-pin; friction roller; taper and split pin.

Barrels.

Cartridge Carrier.—Lever.

Centre Cross-piece.—Fixing-screws, cover lock with fixing screw.

Cover.—Hopper catch with screw; pivot screws.

Elevating Bracket.—Joint pin and fixing-screws.

Fore Sights.—Fixing-screws.

Frame.—Cotters; drill stop; hand lever catch and screw; joint-pin, shield holders (right and left) with fixing screws.

Front Cross-pieee.—Bolts and nuts.

Hand Lever.

Distributor.

Hoppers.

Rear Cross-piece.—Trigger comb and screws; trigger comb-spring; traversing slide; traversing bolt and nut, split pin for do., quadrants (right and left) with joint pins and keeper screws.

Link Bar.—Links (left and right), with pivot screws; friction roller, with stud, set screw, and keeper screw.

Shield.—Fixing bolts (right and left) with stop screws.

Tangent Sights.—Springs; pinions, with hand wheels and fixing pins; split pins.

CONE MOUNTING.

Cone.—Stem, keeper plate with pivot screw, catch pin, spiral spring, collar, fixing pin, and stop nut.

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Elevating Gear.—Consisting of brake with pivot screw, set screw, milled head, and keeper screw; hand wheel, inner screw, outer screw; joint pin with collar and taper pin.

Head Stock.—Stem; cotter with chain and stud, clamping screw and hand nut.

T-Joint.—Clamping screw and hand nut.

Traversing Gear.—Consisting of hand wheel with taper pin; collar and taper pin; spindle and worm.

Instruction for Stripping and Assembling Gun.

Take off cover; draw back hand lever until the extractors are well clear of the cartridge carrier; lift out cartridge carrier.

Push forward hand lever until the extractors are within $1\frac{1}{2}$ inch of barrels, and lift out action block (strip action block in the same manner as 4-barrel 1·0″ gun); draw trigger comb spring out to the rear; turn screws half round and lift out trigger comb.

N.B.—*The following parts are never to be removed unless absolutely necessary.*

Support muzzle end of gun, and take off elevating bracket.

Drive out cotters; take out joint pin and fixing screws from centre cross-piece.

Spring the frame open at the rear end, and draw out the rear cross-piece.

Take out keeper screws and drive out quadrant joint-pins; remove cartridge carrier lever; remove link bar, links, and quadrants; take out split and taper pins from axis pin, and remove hand and action levers; remove traversing slide.

Take pivot screws from links and remove quadrants.

Take keeper screw from stud and remove friction roller.

To assemble gun.—Reverse the above operations.

The instructions in cleaning the 4-barrel 1-inch gun will apply to this gun.

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Proportion of Spare Parts and Tools.

Species.	Proportion allowed per Gun.
Extractors	10
Hammers	2
Pins, firing	10
Screws, extractor	10
Sights, fore, with fixing screws, Right	1
Sights, fore, with fixing screws, Left	1
„ tangent, with split pin, spare	2
Springs, Lock	10
Springs, Sight, tangent	2
Springs, Trigger comb	2
Tools.	
Cans, oil	1
Drifts, brass wire	1
Drivers, screw	1
„ „ for extractor screw	1
Punches, pin, of traversing spindle	1
Rods, cleaning	1
Spanners	1

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GATLING GUNS.

NOMENCLATURE.

The following are the names of the principal parts of the gun :—

- Barrels.
- Block, pivot.
- *Bolts
  - Cam.
  - Fixing, pivot block.
  - Pivot.
- †Boss, elevating pin.
- Boxes, tin, for screws, fixing locks.
- Bracket, tangent sight complete, with fixing screws, set screw, and steel spring.
- Cam, complete, with steel seating, and two screws.‡
- Cartridge carrier.
- Cascable plate.
- Casing, breech.
- §Cocking arrangement complete, with cover, fixing screws, pin block, spiral spring, and steel cam.
- Collar, front of main shaft.
- Cover „ „
- Crutch or roller gear.
  - Carrier, complete, with
    - cross pin hand wheel.
    - distance piece, metal.‖
    - fixing screw, for steel spring.
    - hand wheel.
    - rocking boss.
    - set screw.
    - stop pin.
    - screw bolt.
    - steel spring.
  - crutch or roller, stem, and keeper screw.
- Discs
  - front, carrying gun barrels.
  - rear „ „
  - inside of casing.
- Drum, cartridge.
- Gun frame.
- Handle, crank.
- Hasp, fastening hopper, complete, with joint pin, push piece, split key, spiral spring, and catch.

---

* 0·65″ guns have a bolt for breech casing. † 0·65″ guns only.
‡ 0·65″ guns have only one screw.
§ 0·65″ guns have no cover or pin block, but have a keeper plate.
‖ 0·45″ guns only.

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Hopper, feed drum, complete, with bracket, joint pin, two fixing screws, guide pin, cartridge clearer, and two screws for do.

- Locks
  - complete.
  - *parts of
    - butt.
    - extractor.
    - hammer.
    - firing pin.
    - plunger.
    - screws, fixing
      - butt.
      - extractor.
    - spring.

Lock-cylinder.

Lock extractor complete, with loose ring, set screw for do., spiral spring, jointed handle and pin, and curb chain with rings and stud.

- Nuts
  - bolt, pivot.
  - check, adjusting screw, main shaft.
  - guide, rear.
- Pins
  - worm, revolving.
  - disc, front.
  - handle, crank.
  - nut, guide, rear.
  - carrier, cartridge.
  - nut, hexagon, spindle.
  - split
    - wheel, worm, revolving.
    - bolt, pivot.
- Plates
  - bearing, main shaft.
  - †trunnion
    - left.
    - right.

Rests, crank handle, complete, with spring and spring washer.

Rings, securing, with 10 set screws.

- Screws
  - adjusting main shaft.
  - breech casing
    - †$\frac{3}{4}$″
      - long.
      - short.
    - $\frac{5}{8}$″.
    - $\frac{1}{2}$″.
  - †fixing
    - boss, elevating pin.
    - trunnion plates.
  - crank handle rest.
  - socket, disc inside casing.

Shaft, main, complete, with three feathers.

---

* 0·65″ guns have an additional loose ring. † In 0·65″ guns only.

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Sights { fore (with fixing screw in 0·45″ guns).
tangent.

*Slide, traversing arrangement, complete with pawl, joint pin for do., push piece with spring for do., stud bolt, nut for do., and split pin for do.

Socket, disc inside casing.

Spindle, revolving, parts of { collar.
cones, worm traversing.
nut, fly.
„ hexagon.
„ worm traversing.
spindle.
worm revolving.
worm traversing.

Washer, bolt, pivot.

Wheel, worm, revolving.

N.B.—In 0·45″ guns issued with the new traversing gear, substitute as follows:—

For spindle, revolving parts of { cones, worm traversing, read cones cam traversing.
nut worm traversing, omit.
worm traversing read cam traversing.

Directions for taking to pieces.

To remove Locks.—Turn the gun until No. 8 on the rear disc is opposite an arrow-head, which will be found on the hopper. Turn the lock extractor to the right, against the stop, withdraw with left hand, whilst the crank is moved slightly to and fro with the right: the lock No. 1 will now come from the gun with the extractor. Re-insert the extractor and bring No. 9 opposite the arrow-head, and repeat the operation until all the locks are out. In ·45-inch guns it will be necessary, after the extractor has been withdrawn about 2 inches, to turn it a little to the left in order that the collar may clear the cascable button, a part of the collar being cut away for the purpose. In 0·65-inch guns, to bring away No. 1 lock, set No. 9 opposite arrow-head, and to bring away No. 2 lock, set No. 10 opposite arrow-head.

Mechanism.—Take out lock extractor and unscrew cascable plate (a tap with mallet on the end of the wrench will assist).

---

* 0·65″ guns have not this.

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Drive the taper pins out of the hexagon nut and revolving worm, unscrew nuts, hexagon and fly; remove traversing worm or cam and cones, and withdraw crank and revolving spindle; drive split pin out of worm wheel, and remove with screw cramp.

See that the gun is supported by the frame only, not by the breech casing. Take out casing screws, and remove cover and spring of cocking arrangement. Turn back the hopper.

Place the gun-metal bridge across the frame of the gun a little in front of the pivot block, pass the brass band under the barrels and hook on to the iron bridge, push the assembling rest back as far as it will go, and by turning the nut take the weight of the barrels, &c.; the breech casing may now be drawn off, care being taken that the shaft and barrels are not drawn backward at the same time, as, should the fore end of the shaft be drawn out of its bearing in the frame, the barrels would fall.

Drive out the taper pin, remove the rear guide nut by turning the nut to the right (left-handed thread) with jib-key, whilst holding lock cylinder with another. The lock cylinder and cartridge carrier can now be drawn off the shaft.

To remove Barrels from Frame (if necessary).—Draw the shaft and barrels back a little, slack out the assembling rest, and rest the rear disc on the back edge of the pivot block. Place two pieces of copper rod in the top barrels (the copper must be as near the size of the bore as possible), to stand out about 6 inches. The rear end of main shaft will be held by one man, whilst another, having hold of the copper rods, moves the barrels a few inches back; they will now be clear of the frame. In ·65-inch guns, instead of using the copper rods, pass a sling between the frame and under the barrels near the fore disc, letting two men lift with a handspike passed through the sling.

To remove the Main Shaft from Barrels.—Support the barrels in wooden **V** blocks, just behind the fore disc, and in front of rear disc; drive the shaft out from rear end with a baulk of timber, having a man to steady fore end of shaft and front disc as it leaves the barrels.

To strip a Lock.—Take out fixing screws, remove extractor and unscrew butt; draw spiral spring through end, and hammer and firing pin through slot in plunger.

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Directions for putting the Gun together.

Screw barrels into rear disc, until extractor slots in each coincide. Put on securing ring and fix set screws. Fix front disc on main shaft, pass shaft through rear disc and fore disc over barrels; drive into position with baulk of timber.

Slide the cartridge carrier (with steady pin) on shaft, then the lock cylinder, lastly screw on rear guide nut until a line at the bottom of one of the grooves corresponds with a similar line on the lock cylinder; drive taper pin in rear guide nut.

Put in pivot bolt (not in ·65-inch guns if to be used with cone mounting).

Place bearing plate and collar in bearing at the fore-end of frame, insert fore-end of shaft, allowing the rear disc to rest upon the back edge of pivot block, whilst the assembling rest is adjusted to take the weight.

Place the cocking arrangement in breech casing, slide on the breech casing, raising or lowering the shaft (by means of assembling rest) to suit the hole in disc inside casing; put on cover and spring for cocking arrangement, and screw in casing screws; drive on worm wheel and fix split pin, opening out the ends.

Pass the crank shaft through the hole in casing, put on the collar, then, holding the revolving worm in position, push the shaft through to its place; drive in pin of revolving worm, and screw nut on end. (In 0·65-inch guns there are two plain taper pins in revolving worm.)

Put traversing gear on crank shaft in the following order:—Cone with large hole, traversing worm or cam, cone with small hole, fly nut, and hexagon nut; drive in taper pin.

Screw on cascable plate until a notch upon it corresponds with a similar one on the top of breech casing. Turn gun until No. 8 on rear disc coincides with arrow-head (if a 0·65-inch gun, let No. 9 coincide).

Insert No. 1 lock, push it up to its place with lock extractor, turn gun until No. 9 and arrow-head coincide, withdraw lock extractor, insert No. 2 lock, and continue in the same order.

Leave lock extractor in gun.

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Adjustment.

To ensure the free working of the gun, and at the same time to guard against miss-fires, a certain amount of longitudinal freedom must be given to the main shaft.

Insert a dummy cartridge or an empty cartridge case in the chamber of one of the barrels; turn the gun round until this barrel is in firing position, set the barrels up to this by screwing in the adjusting screw, care being taken not to force them up, merely feel the pressure; now unscrew $\frac{1}{6}$th of a turn, or revolution, and lock in position by the check nut. In choosing a cartridge case, see that the head is in good condition, and that the body fits loosely in the chamber, otherwise some difficulty will be experienced in feeling when it is home in the cartridge head recess. The adjusting screw will be found by taking off the gun-metal cover on front of frame.

To enable the gun to fire the Gardner and Gatling ammunition, the steel cartridge head gauge (marked ·077″) must be used both for adjusting the gun as above and for testing the length of extractors (*see* non-extraction); should any of the extractors be found short, they may be taken from the lock, and drawn out to the necessary length; if, after lengthening, they are found to grind against the hopper, the hopper must be eased away with a file.

Miss-fires.

In practice, should miss-fires occur, the gun should be at once tested to see that there is not too much end play in the main shaft.

Non-extraction.

See that the extractor is not broken or worn to an obtuse angle at the hook, that the extractor slot in barrel is clean and corresponds with slot in rear disc, that when the extractor is pushed back as far as it will go there is sufficient distance between hook and fore-end of lock; this may be determined by drawing back the firing pin, and placing a cartridge case on fore end of lock; the hook should now be at least ·02″ from the front edge of cartridge head.

Stiffness in Working.

Stiffness may be due to:—

(*a.*) Cartridges which may have some such defect as high to gauge, rim too thick, or body of case bulged in loading.

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(*b.*) End of barrel set up. This is caused by working the gun without cartridges; the lock snapping drives the end of the lock into the chamber, and throws up a burr at entrance; this can be removed by a burnisher.

(*c.*) Not sufficient freedom in shaft. This is due to the barrels not being adjusted properly to allow for the expansion by heating. It can be remedied as previously explained under the heading *Adjustment.*

(*d.*) Steel plate on face of cam becoming indented. This steel plate, which receives the blow from the lock on firing, should stand a little above the brass, so that the lock will pass freely over after firing.

(*e.*) Lubrication of locks. Should a cartridge burst at the base, a deposit will be left in the carrier or lock chamber, and prevent the free working of the lock; in this case the lock should be removed and the part cleaned.

(*f.*) Worm wheel may require cleaning and oiling; to do this remove the cascable.

Instructions for replacing a Barrel.

Turn back the set screw in securing ring, and screw out the old barrel, retaining it as a pattern for slotting the new one. The 0·65-inch gun, and earlier numbers of 0·45-inch, require to be stripped to get out the barrel.

Screw in the new barrel hard up against the shoulder for position; mark off position of the extractor slot on the barrel, and with care file out slot at this mark. Copy the round shape of the first angular face of the groove, the other can be flat.

Before assembling gun, drill the centre in the barrel for the point of set screw in securing ring.

The under-mentioned tools are required for this operation:—

(*a.*) *For 0·45-inch gun.*

Files,	6-inch,	pillar, rough (½ inch wide) -	3
„	4 „	square, smooth - - -	2
„	4 „	3-square, bastard (blunt point) -	2
„	3 „	3-square, smooth „ -	1

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(*b.*) *For 0·65-inch gun.*

Files,	4-inch,	3-square, blunt, smooth - -	1
„	4 „	„ „ bastard - -	1
„	8 „	square, taper, smooth, one safe edge - - - -	1
„	8 „	square, taper, smooth, two safe edges - - - -	1
„	8 „	hand, or safe edge, bastard -	2

INSTRUCTIONS FOR PLACING SECURING RINGS ON BARRELS OF GATLING GUNS.

A drill is sent with each ring; this drill must be fitted to a crank brace, so that it runs true; care must be taken in using it to keep the point *well* supplied with oil.

Each ring is marked from 1 to 10; let these numbers correspond with the numbers on the rear disc, and when once on, mark the ring with the register No. of the Gun, opposite the register number on the disc.

Strip the gun and take the shaft and the fore-disc from the barrels; *see that the extractor slots in the barrels and the rear disc coincide;* pass the ring over the barrels and let it rest upon the rear disc; tighten up all the set screws; take out No. 1 screw, pass the drill through the hole in the ring and drill a centre in the barrel $\frac{3}{32}''$ deep; clean out the hole, put in the screw, and proceed with No. 2 barrel; when all the centres are drilled, ease back the screws, take off the ring, and see that the centres are of an uniform depth of $\frac{3}{32}''$. The barrels of most of the 0·45″ guns being larger where they pass through the fore-disc than at the breech end, it will be necessary to spring them in slightly whilst the ring is being passed over the enlargement. Should the ring not go well down on to the rear disc, smear the barrels with red lead or lamp black mixed with oil, and, having forced the ring as far as it will go by hand, take it off and scrape away the parts marked by the colouring; continue this until the ring is well home, always observing to put the ring on in the same position.

TO CONVERT CRUTCH TO ROLLER GEAR FOR 0·45″ GUNS.

The following parts and tools are issued :—

Parts—1 traversing cam, to replace traversing worm and nut.
1 stem with roller and keeper screw, to replace crutch.
1 piece of gun metal for filling slot in carrier.

Tools.—1 cutter with bit to fit ordinary hand brace.

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Take the crutch from carrier.

Fit the piece of gun-metal into the slot in the carrier and solder it in; insert the small end of the cutter, and enlarge the hole to suit the point of the screw bolt in traversing plate; now reverse the cutter on the brace bit and clear out the hole to the depth of the original slot.

Assemble carrier with roller stem (in some guns of early date the set screw may not tighten on to the stem before the stop pin comes in contact with the stop, in which case a piece of sheet metal must be fitted into the *slot in the stem*).

Remove traversing worm from spindle, and replace with traversing cam.

Keeper Screw in Roller Gear working loose.

Should it be found in working the gun that the keeper screw has a tendency to turn, the head should be reduced in diameter (in a lathe, if possible; if not, with a file), so that the friction roller does not, under any circumstances, bear upon its edge.

Spare Parts (0·45-inch gun) No. 1 Chest.

Barrel				‡1
Handle crank				‡1
Locks	complete			¶4
	parts of	extractors		¶8
		hammers		¶2
		pins, firing		¶8
		screws, fixing	butt	†16
			extractor	†16
		springs		¶12
Pins	handle crank			1
	nut, hexagon spindle			1
	worm revolving			1
*Screws, breech casing, $\frac{5}{8}$ inch				5
" " $\frac{1}{2}$ "				1
Sights	fore, with fixing screw			¶2
	tangent			2
Spindle, revolving parts of	collar			‡1
	cones, worm or cam traversing			‡2
	nut fly			‡1
	nut, hexagon			‡1
	nut worm traversing			‡1
	spindle			‡1
	worm revolving			‡1
	worm or cam traversing			‡1

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Spring spiral cocking	¶6
Wheels, worm revolving	‡1

* For 0·65 guns $6\frac{3}{4}$-in. screws, three long and three short.

† Carried in tin box.

Spare drums, two for each gun fitted for sea service, are carried separately.

NOTE.—When the gun is required for service on shore, the spare parts, with the exception of those marked ‡, and half the proportions of those marked ¶, are stored in the limber boxes, in which there are leather fittings for the purpose; the remainder are kept on board.

SPECIAL TOOLS (0·45″ gun) No. 2 Chest.

Assembling rest, parts of	bridges	band, brass	*1
		gun-metal	*1
		iron	*1
		nuts, brass	*1
Burnishers, steel chamber of barrel			2
Cramp, drawing off worm wheel		cramp	*1
		screw steel	*1
Drivers, screw, for lock		$6\frac{1}{2}$ inches	1
		§7 „	1
Key	box,	removing screws in casing	*1
		for lock: body	1
		for lock: breech	1
		pin, nut, worm, revolving	*1
		unscrewing barrels	*1
	jib,	lock cylinder	*1
		rear nut	*1
Pin key box, removing screws, breech casing			*1
Punch, pin, rear nut			*1
Rod in parts		cleaning iron	†1
		clearing steel	†1
		handle iron	†1
Spanner, adjusting screw in front of main shaft			2
Wrench key box unscrewing barrels			*1

NOTE.—When the gun is required for service on shore, the special tools, with the exception of those marked*, are stowed in the limber box, in which there are leather fittings for the purpose; the remainder are kept on board.

§ $7\frac{1}{2}$ inch for ·65 inch guns.

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The following are supplied with each limber :—

Drums - - -	8	6 in limber and 2 spare
Grease box - -	1	on rear of axletree.
Spare pole with two slots	1	to each ship; kept on board.
Oil can - - -	1	stowed in limber.
Spare linch pin - -	1	
Spare drag washer -	1	
Set of men's harness, light	1	stowed on footboard.
Pair of drag ropes, light	1	
Swingletree.		

The lid of limber box is secured by a padlock.

Two small arm ammunition boxes, containing spare ammunition, can be carried under the limber box, in front.

GUNS, GARDNER, 0·45 INCH, 5 BARREL.

GENERAL DESCRIPTION.

	Cwts.	qrs.	lbs.
Nominal weight of gun, with cartridge feeder -	2	2	10
„ „ „ and shield fittings	3	0	11
„ traversing-gear for tripod mounting - - - -	0	1	9
„ tripod - - - -	0	2	3
„ crosshead, with elevating and traversing gear for cone mounting	1	0	5
„ cone - - - -	0	2	5
„ shield - - - -	0	2	21

Length -	total - - -	53·5 ins.
	barrels - - -	33 „
Calibre - - - - -		0·45 „
Rifling -	Nature - - -	"Henry."
	No. of grooves - -	7
	twist, uniform - -	1 turn in 22 ins.
Ammunition : Gardner and Gatling -		0·45 in. (mark I.)

These guns have five barrels, their axes lie in a horizontal plane, and are parallel to each other. The breech ends are fixed into the centre crosspiece of the frame. To the rear of the centre crosspiece the frame is increased in depth to form the breech-casing; in this casing are the locks which carry the mechanism for igniting the cartridges and extracting the empty cartridge-cases. The locks are driven backward and forward by means of a disc-crank—at the forward motion the cartridges are pushed into the barrel chambers and there held during the time of discharge, whilst during the backward motion the empty cases are withdrawn.

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The extractor is pivoted to the lock-plunger, during the forward motion of which it is free to rise over the cartridge-head, whilst during extraction it is held firmly down to the plunger by the feed-valve, which receives a slight motion from the cam on the disc-crank for this purpose.

A safety bar is added for drill purposes; when the handle is down, or in safe position, cartridges may be worked through the gun unfired.

The gun is fed from a grooved plate or cartridge-feeder, which is fixed above the hopper, through openings in which the cartridges fall from the cartridge-feeder to the cartridge-carrier.

Between the hopper and the cartridge-carrier is the feed-valve, in which are openings corresponding with openings in the hopper; it has a transverse motion, for the purpose of bringing the cartridges from the openings in the hopper to a position opposite the barrels and in line with the lock-plungers.

The cartridge-feeder contains 100 cartridges, in five columns of 20; this is kept supplied during firing from cartridge-holders, of which 20 are sent with each gun. The cartridge-holder is a wood block, with holes sunk to contain 50 cartridges; when filled the slide is put on, care being taken to keep the brass strips *inside*. The wooden slides will gradually be replaced by brass ones.

The guns are sighted up to 2,000 yards, except some of the earlier ones, which are only sighted to 1,600 yards.

Mounting.—The gun is furnished with a tripod and three gunwale sockets; the tripod is held in position by the head of the holding-down bolt being passed through the slot in deck-plate, after which the holding-down screw is screwed into the socket until a firm hold is obtained.

The gunwale sockets are held in brackets (not issued with the guns) in any position on bulwarks.

The traversing gear is for use in both the tripod mounting and the gunwale sockets.

For service on shore.—A Gatling carriage has been fitted with a fixed socket, into which the stem and traversing gear can be dropped.

Guns numbered above 774 are fitted with cone mountings, Mark II. tangent sights, and shields. The 275 guns at present in the service, issued with tripod mountings and ordinary tangent sights, will gradually be fitted with cone mountings, Mark II. tangent sights, and shields.

The cone mounting consists of the cone, crosshead, traversing and elevating gear. The cone fits into the service

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holding-down ring; it is bored out to receive the stem of the worm-wheel, and is furnished with a locking-bolt, to prevent the worm-wheel turning when it is screwed into position. The crosshead carries the elevating and traversing gear.

The elevating gear consists of telescopic right and left hand screws, working in a nut pivoted to the crosshead; it is furnished with a brake.

The traversing gear consists of a worm-wheel, and worm and spindle; the worm-wheel is attached to the crosshead by means of clips.

The crosshead with elevating and traversing gear may be unscrewed from the cone, and used either in the field carriage or gunwale socket; when it is desired to do this, turn and drop the locking-bolt, take the gun by the fore end of the frame, and the opposite side to the crank-handle, and pull it until the screw (right hand) upon the stem of the worm-wheel is slack; it will now require three turns to release it from the thread in the cone, when it may be lifted out. If, from the position of the gun, it cannot be turned an entire revolution, it must be first slacked out by the above means, then, by turning the traversing hand-wheel, the stem will be released after the worm-wheel has made three revolutions.

In replacing the gun in cone care should be taken to lower the stem gently into its place, that the threads may not be damaged.

The cone is *not* to be released from the holding-down ring by means of the gun frame, but by blows with the end of a wooden handspike delivered upon the lugs which will be found at the base of the cone.

The Mark II. tangent sight consists of a slide upon which teeth are cut to form a rack, a stem, and a spring, which snaps into a recess in the slide, and acts as a stop when the stem is drawn out to its full extent. The slide is marked on its right edge from 0 to 1,300 yards, and on its left edge from 1,400 to 2,000 yards. The right-hand marking is for use when the head of the stem is resting upon the top of the slide; the left-hand marking for when the stem is *fully* withdrawn. The sights are interchangeable, and may be used either as right or left hand.

The shield consists of a steel plate, which is held in holders swinging on the sides of the frame; it may be clamped at any desired angle by the friction locking gear, and when not in use may be turned down over the cover, in which position it serves to secure the cartridge-feeder

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which is first laid upon the barrels, grooves downwards; the shield itself bears upon the *back*, and the feeder-catches, which are pivoted to the frame, clip the *ends* of the cartridge-feeder.

Instructions for Armourers in Stripping and Assembling Gun.

To dismount the Shield.—Drive out the taper pin from shield holders and lift out the shield; replace the taper pins, unless it is required to strip the friction locking gear, in which case, while the pins are out, draw off the shield holders, when the shaft will come away, and may be stripped. When reassembling, see that the friction collars are placed in proper position; they are marked R. and L., for right and left hand.

To remove Locks.—See that the safety bar is in firing position; open the cover and turn the crank until the crank-pins are at the top, when in this position the fore ends of the plungers will be about 2 inches from the breech ends of barrels; take hold of the plunger and raise it, at the same time moving the crank slightly (great care being taken not to allow the locks remaining in the gun to come within 1 inch of the breech ends of the barrels); the lock will now come away.

N.B.—By not following the instructions as to position of crank, the lock in some of the earlier guns may be caught so that it can neither be taken out nor put back; in this case the safety bar must be forced into safe position, when the lock will come away.

Before putting the lock in again, the safety bar must be returned to firing position.

To remove Crank.—Place the flat part of spanner in the slot of left axis pin, letting the cross-piece, or screw driver end, rest upon the frame to the rear; take hold of the crank handle and give a smart backward turn, this will loosen the left axis pin; it will not be taken quite out until the right axis pin is loosened, which is accomplished by placing a piece of hard wood between the crank and rear end of breech-casing, and turning the crank handle backwards; both axis pins being removed, the crank may be lifted out.

To remove the Cam Levers.—Take out the set screws which will be found underneath the breech-casing, and drive out the joint pins.

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To remove Feed Valve.—Take out the pivot-screw from the feed-valve lever; the feed valve will now slide out.

To remove the Barrels.—Take out the fixing-screws from the muzzle and breech, push the barrel and bush forward until the breech end is clear of the centre cross-piece; take the bush from the muzzle, and draw the barrel to the rear clear of the gun.

To strip the Mark II. Tangent Sight.—Drive out the taper pin, and take off the milled head, take out fixing-screws and remove bracket, take out pinion, then remove sight and spring; when it is necessary to take out the stem, the stem spring must be forced back by pressing a piece of wire through the hole in the slide, the stem may then be withdrawn.

To strip a Lock.—Compress the spring by means of the hammer; place the jaws of the spanner over the spring, as low as possible, this will keep the spring compressed; when the hammer is released the spring may be taken from the lock; take out the hammer; drive out the fixing pin from the plunger and draw off the butt; take out the firing pin; drive out fixing pin and remove extractor. If it is necessary to remove the spring from the spanner, compress the spring in a vice, or between the frame and cover of gun, when it will be left free of the spanner. Care must be taken to hold the open end of the spring in the vice, and not the turned end.

N.B.—The locks of all Gardner guns should be taken out and oiled monthly.

To Assemble Gun.—Reverse the above operations, taking care, in replacing the locks, to have the crank-pins in the same position as directed for stripping, and that the end of the hammer is under the crank, and *not* in the opening in the disc.

Miss Fires may be caused by a weak lock spring, the weight of the spring may be tested with a wire and spring balance; it should require a pressure *not less* than 10 lbs. to press the point of the firing pin back slightly.

Non-extraction.—Should any cases of non-extraction occur, owing to the extractor rising over the cartridge head during the backward movement of the lock, the feed valve must be adjusted to bear upon the extractor; to do this the adjusting screw in the right end of the lever must be drawn out slightly, and fixed with the set screw.

To replace a Barrel.—The spare barrel is interchangeable as regards diameter; should the fixing screw be found

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difficult to enter, the groove in the barrel may be eased away with a round file until the screw goes home.

THE FOLLOWING TOOLS ARE ISSUED WITH EACH GUN.

Cleaning rod		1
Clearing plug		1
Punches -	3·32-in.	1
	3·16-in.	1
Spanner		1
Tommy, for guns with tripod mounting only		1
Tommies, small	2	For guns with cone mounting only.
Key-jib for bearing-nut	1	
Screwdriver	1	

The clearing plug is used as follows: should the body of a cartridge case remain in the chamber after the head has broken away, take out the lock and introduce the clearing plug from the breech, turn the plug with the spanner until the threaded part obtains a fair hold in the case, then with the cleaning rod, used from the muzzle, push or tap out the plug, when the case will be found to come away with it.

Elevating gear.—If the hand nut will not tighten up the brake, by reason of its coming in contact with the breech-casing, slack out the set-screw and turn the locking-screw until the hand-nut tightens in the desired position, then fix with set-screw. The nuts on the holding-down bolt should be so adjusted that the thread can be screwed about half its length into the socket before the head of the bolt commences to tighten in the deck-plate.

To strip the traversing gear in cone mounting.—Drive out the taper-pin, and take off hand wheel, take off the adjusting-nuts and collar, then take out bearing-nut with the gib-key, supplied for that purpose.

To strip the elevating gear in cone mounting.—Drive out joint pin; take out fixing screw, and remove strap and shoe. The screws may then be taken from the gun-metal nut. In reassembling see that the arrows marked on the threads coincide.

N.B.—Pins without heads are to be driven *out from the left.*

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Nomenclature of Parts of Gun (showing the proportion of Spare allowed).

| Gardner Gun, 5-barrel, parts of. | | |

Gardner Gun, 5-barrel, parts of.		Spare.
Screws, fixing	Barrel, breech	5	
	„ muzzle	5	
	Cartridge-feeder	1	
	Foresight	4	
Shield, complete, consisting of	Collar, centre with 1 lever and 1 stud	1	
	„ friction with 1 feather, left	1	
	„ „ „ right	1	
	Feeder-catch, with 1 spring, 1 joint-pin, and 1 fixing-pin, left	1	
	Feeder-catch, with 1 spring, 1 joint pin, and 1 fixing-pin, right	1	
	Plate, feeder-catch, with 1 fixing-screw, left	1	
	Plate, feeder-catch, with 1 fixing-screw, right	1	
	Plate axis, outside, left	1	
	„ „ right	1	
	Plate axis, inside, left	1	
	„ „ right	1	
	Screws, axis-plates, $\frac{5}{8}''$	2	
	„ „ $\frac{5}{8}''$ long heads	2	
	„ „ $\frac{3}{8}''$	2	
	Shaft	1	
	Shield	1	
	Shield-holder, with 1 taper-pin, 1 chain, 1 ring, and 1 stud, left	1	
	„ „ „ right	1	
	Studs, feeder-catch, with 1 fixing-pin each	2	
Sights	Fore	2	2 per gun.
	Tangent*, mark I.	2	
	Tangent, mark II., consisting of: Slides, 2	2	
	Springs, stem, 2		
	Stems, 2		
†Stem, with 1 joint-pin, and 1 split-pin		1	
Tangent sight-bracket, complete with	Brackets left	1	
	Brackets right	1	
	Cams‡	2	
	Screws, fixing	4	
	Springs	2	2 per gun.
Cone mounting, consisting of	Cone, with 1 locking-bolt, 1 bush, 1 cap, and 2 fixing screws for ditto	1	
	Crosshead, with 1 front-clip, 1 back clip, 4 fixing-screws, 1 front keeper-plate, 2 back keeper-plates, 3 studs, and 3 fixing-pins for keeper-plates, 1 joint-pin, and 1 fixing-pin for ditto	1	

* Not required with guns with mark II. tangent sights.
† Not required with guns with cone mountings.
‡ All guns numbered above 574 have:—
2 pinions
2 milled heads
2 fixing pins
} instead of 2 cams.

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Gardner Gun, 5-barrel, parts of.								Spare.
Cone mounting, consisting of -	Elevating gear, consisting of	Brake, complete with -	milled head	1				
			taper-pin -	1				
			set-screw -	1				
			shoe, with 1 spring and 1 fixing-screw -	1				
			spiral spring -	1				
			strap with 1 fixing-screw -	1				
		Gun-metal nut -		1				
		Hand-wheel - -		1				
		Inner screw - -		1				
		Outer screw - -		1				
		Joint-pin - -		1				
		Pivot screws with 1 nut each - -		2				
	Traversing gear, consisting of -	Worm and spindle -		1				
		Bearing-nut - -		1				
		Adjusting-nuts -		2				
		Collar - - -		1				
		Hand-wheel with 1 fixing-pin -		1				
		Worm-wheel - -		1				
*Traversing gear, consisting of -	Casing with 1 under plate and 3 fixing screws - - - -			1				1 for every 2 guns or less.
	Crank handle, with 1 fixing-pin; 1 stem, 1 fixing pin for ditto; and 1 gun-metal grip - -			1				
	Set-screws - - - - -			2				
	Worm and spindle, with 1 collar and 2 adjusting nuts - - -			1				
	Worm wheel - - -			1				
*Tripod mounting, consisting of -	Bearing piece, with 1 stop screw -			1				
	Legs, with 1 tie rod and 2 joint pins to each - - - -			3				1 per gun.
	Lug ring - - - -			1				
	Set screw with 1 crosspin - -			1				
	Socket, with 3 joint pins, and 3 split pins - - - -			1				
	Stop nut - - - - -			1				
	Holding down arrangement, complete with	Deck plate -		1				
		Holding-down bolt with 2 adjusting nuts - -		1				
		Holding-down screw		1				
		Lengthening key -		1				

* Not required with guns with cone mountings.

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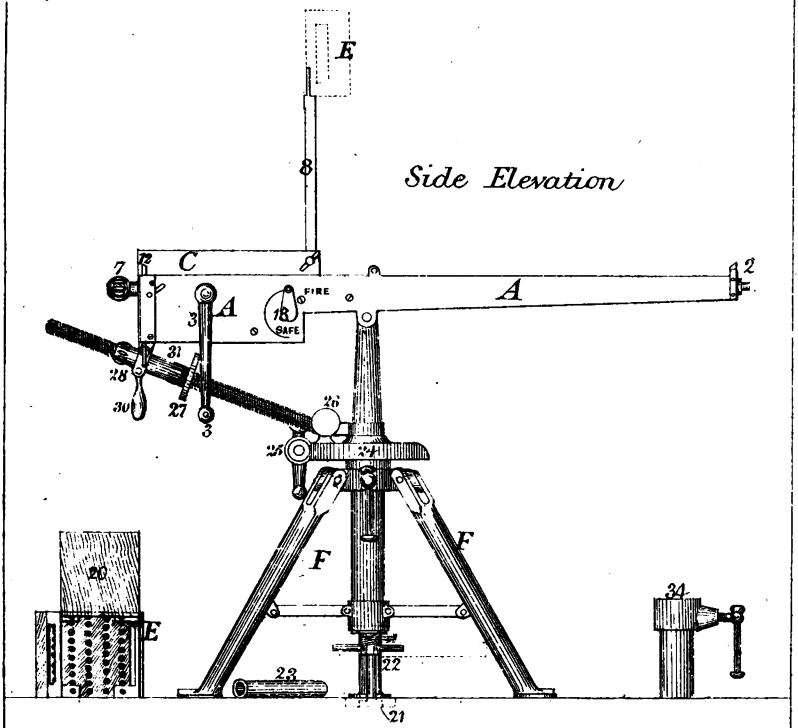
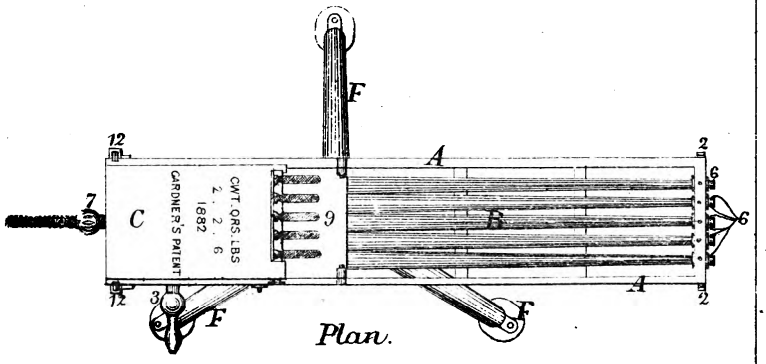
MACHINE GUN. GARDNER.

(5 BARRELS.)

SCALE 1/16.





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DANGERFIELD. LITH 22. BEDFORD ST COVENT GARDEN

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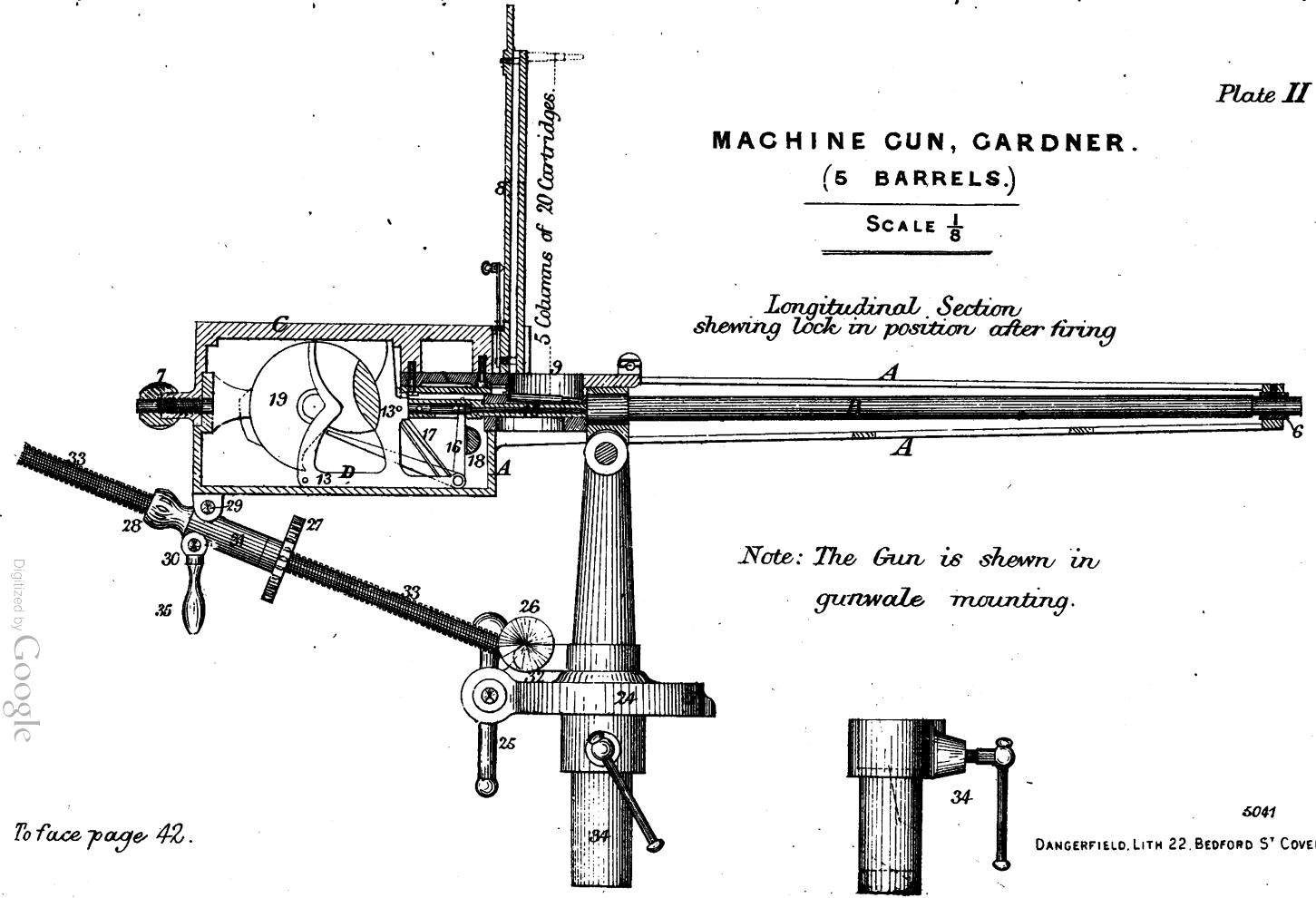
Plate II.

MACHINE GUN, GARDNER.

(5 BARRELS.)

SCALE $\frac{1}{8}$

Longitudinal Section shewing lock in position after firing



Note: The Gun is shewn in gunwale mounting.

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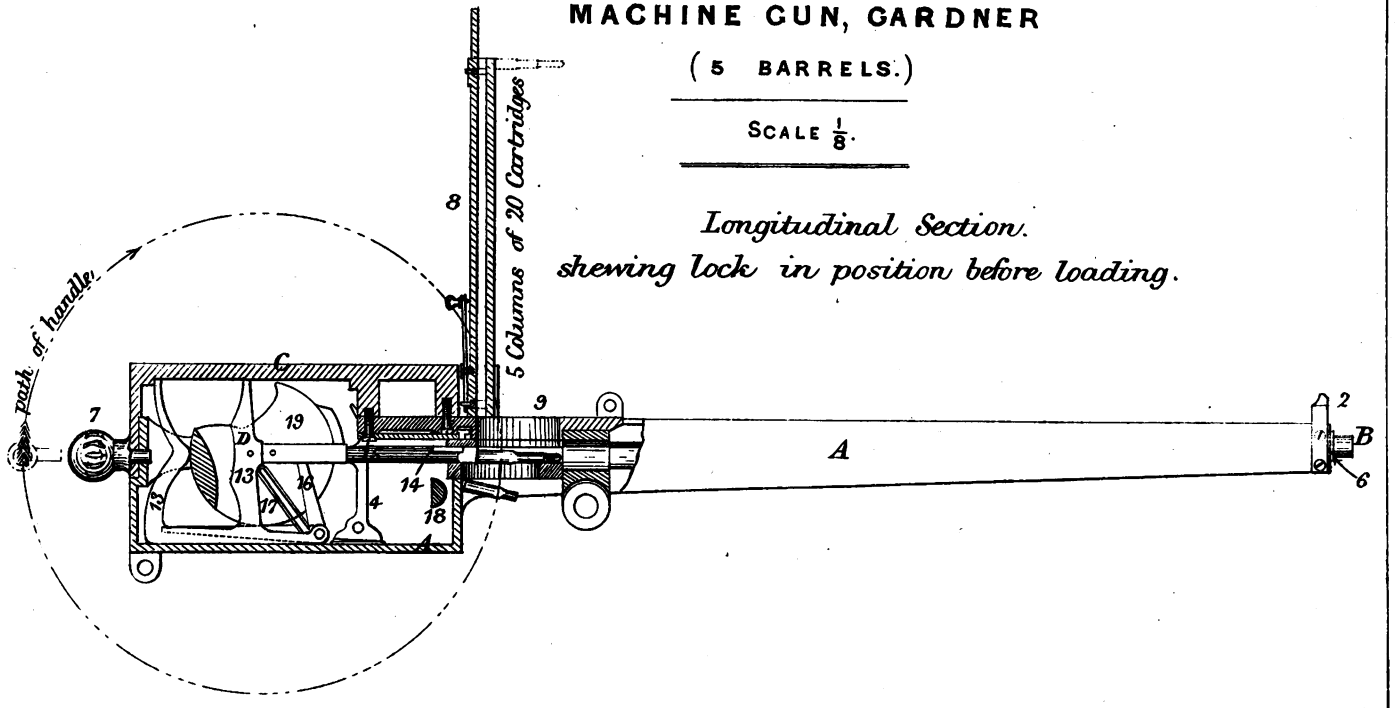
MACHINE GUN, GARDNER

(5 BARRELS.)

SCALE 1/8.

Longitudinal Section.
shewing lock in position before loading.



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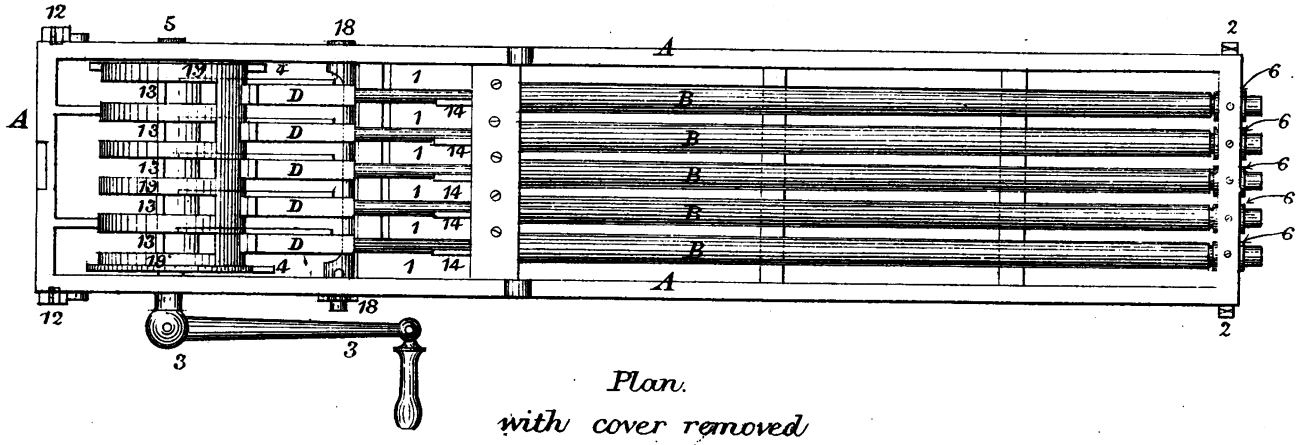
MACHINE GUN. GARDNER.

(5 BARRELS.)

SCALE $\frac{1}{8}$.



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DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN

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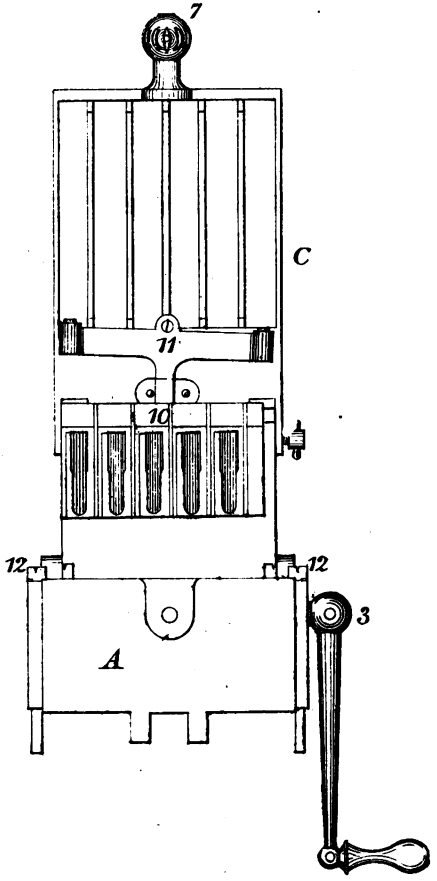
MACHINE GUN, CARDNER.

(5 BARRELS.)

SCALE $\frac{1}{8}$.



Rear View
with cover open shewing
feed arrangement.

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DANGERFIELD. LITH 22 BEDFORD ST COVENT GARDEN

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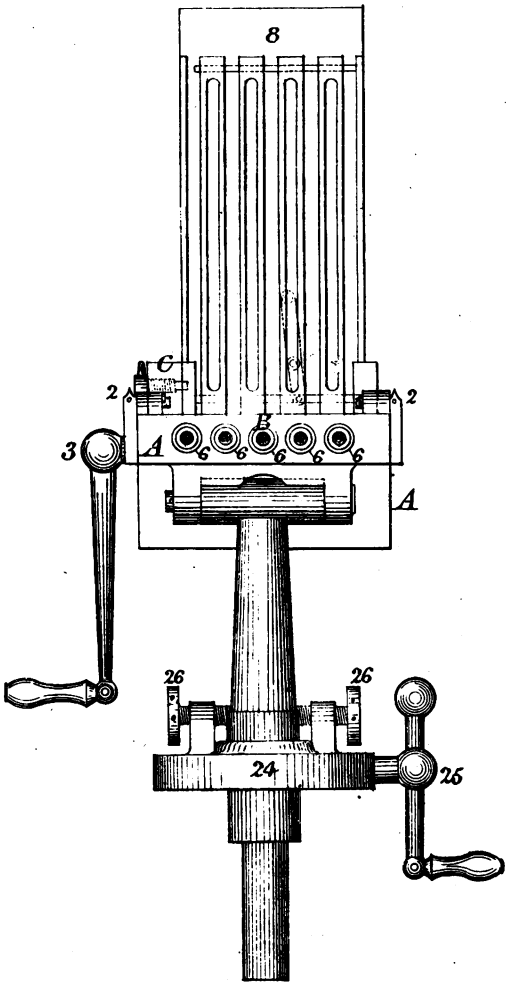
MACHINE GUN, GARDNER.

(5 BARRELS.)

SCALE $\frac{1}{8}$.



Front View

shewing gun and traversing gear removed from tripod mounting.

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DANGERFIELD LITH. 22. BEDFORD S^T COVENT GARDEN.

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GUNS, GARDNER, 0·45″, 1-BARREL, MARK I.

NOMENCLATURE.

Barrel.—Fixing pin for do.

Breech Casing.—Joint pin; hood with 2 fixing screws.

Cam Slide.

Cartridge Carrier.—Two guide pins; fixing plate with 2 screws; ejector; ejector spring; ejector cone.

Cartridge Feeder.

Cartridge Holders.—Covers.

Cover.—Joint pin; cascable screw; cascable knob; extractor guide plate, pivot screw for do.; cartridge feeder catch, collar, spring and pin for do.; stop screw.

Crank, disc.—Axis pin (left); cam.

Crank-handle.—Axis pin (right), fixing pin for do.; gun-metal grip; stem, fixing pin for do.

Fore Sight.

Lock.—Consisting of plunger (left); butt; stud, 2 fixing pins for do.; extractor, fixing pin for do.; firing pin; hammer with axis pin and fixing pin; lock spring; friction roller, axis pin for do.

Tangent Sight.—Spring; fixing pin; pinion.

MOUNTING.

Stem.

Elevating Gear.—Consisting of screw, joint pin for do.; upper nut; lower nut; sleeve, joint pin for do.; locking screw, nut, collar, and set screw for do.

Socket.—Set screw, cross pin for do.; bearing piece, stop screw for do.; one long and two short legs, joint pins and split pins for do.; lug ring; tie rods, joint pins for do.; holding down screw, lengthening key for do.; holding down bolt, 2 adjusting nuts for do.; deck plate.

Sleeve.—(For use with gunwale sockets, or 5 barrel tripods.)

Trasversing Gear.—Consisting of worm wheel; worm and spindle; 2 adjusting nuts; collar; hand wheel; fixing pin for do.; stem; gun-metal grip; casing; under plate and 3 fixing screws for do.; 2 set screws.

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INSTRUCTIONS FOR STRIPPING AND ASSEMBLING GUNS.

To remove Lock and Crank.—Same as 5-barrel gun.

To remove Cartridge Carrier.—Lift up the fixing plate and push out the guide pins, the cartridge carrier may now be lifted out.

To remove the Barrel.—Drive out the fixing pin and draw the barrel forward.

To strip the Lock.—Same as 5-barrel gun.

N.B.—All plain pins are to be driven out from left to right.

To assemble Gun.—Reverse the above operations, taking care, in replacing the lock, to have the crank pin at the top, and that the end of the hammer is under the crank, and not in the opening in disc.

Miss-fires.—See 5-barrel instructions. Weight on firing pin should not be less than 14 lbs.

The following tools are issued with each gun:—

Cleaning rod	1
Clearing plug	1
Punches { 5/32 / 3/16 }	1
Spanner	1
Tommy	1

For use of tools and adjustment of mounting, see 5-barrel gun.

The following spare parts are issued with each gun:

Locks (left)	1
„ springs	1
Leg, short	1

GUNS, GARDNER, 0·45″, 2-BARREL, MARK I.

NOMENCLATURE.

Barrels.—Fixing pin for do.

Cam Slide.

Cartridge Carrier. — Guide pins; ejectors; ejector springs; fixing pins; ejector cone.

Cartridge Feeder.

Cartridge Holders.—Covers.

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Casing.—Hood (left), hood (right), fixing pins, joint pin; cascable screw; cascable knob; extractor guide plate; fixing screws and pivot screw for do.; cartridge feeder catch; collar, spring, and fixing pin for do.; stop screw.

Crank Disc.—Axis pin left; cam.

Crank Handle.—Axis pin (right), fixing pin for do.; gun-metal grip; stem; fixing pin for do.

Fore-sight.

Front Disc.—Fixing pin.

Locks.—Consisting of plungers, left and right butts; studs with fixing pins; extractors with fixing pins; firing pins, hammers with axis pins and firing pins; springs; friction rollers with axis pins.

Safety Bar.—Spring; screw; centre stud; knob.

Shield.—Shield holder; locking screw; fixing screws; taper pins with chains, studs and rings.

Tangent Sight.—Slide; stem; stem spring.

Tangent Sight Bracket.—Pinion; milled head; fixing pin, spring.

Cone Mounting.

Cone.—Locking bolt; bush; cap with fixing screws.

Crosshead.—Front and back clips with fixing screws; front and back keeper plates with studs and fixing pins; joint pin.

Elevating Gear.—Consisting of brake complete with milled head; taper pin; set screw; shoe with stop spring and fixing screw spiral spring; strap with fixing screw; gun-metal nut; hand wheel; inner screw; outer screw; joint pin with fixing pin; pivot screws with nuts.

Traversing Gear.—Consisting of worm and spindle; bearing nut; adjusting nuts; collar; hand wheel with fixing pin; worm wheel.

For instructions regarding the cone mounting, *see* 5-barrel gun.

Instructions for Stripping and Assembling Gun.

To remove Locks and Crank.—Same as 5-barrel gun.

To remove the Cartridge Carrier.—Lift up the right hand hood and push out the guide pins, the cartridge carrier may now be lifted out.

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To remove the Safety Bar.—Lift up the right-hand hood and draw the safety bar out.

To remove the Barrels.—Drive the fixing pins out from front disc and barrels, and draw the barrels forward.

To strip a Lock.—Same as 5-barrel gun.

To assemble Gun.—Reverse the above operations, taking care to put the right and left-hand locks in correct positions.

Adjustment.

Same as directed for 1-barrel gun.

Spare Parts.

The following spare parts are issued with each gun :—

Barrels	1
Cartridge holders	5
Extractors	4
Hammers	1
Handles, crank (to every 2 guns)	1
Locks (left)	1
„ (right)	1
Pins, extractor	4
„ firing	4
Sights, fore	1
„ tangent	1
Springs, lock	4
„ sight, tangent	1

Tools.

Cleaning rod	1
Clearing plug	1
Punches $\frac{5}{32}$"	1
Punches $\frac{3}{16}$"	1
Spanner	1
Tommies	2
Key jib, bearing nut	1
Screw driver	1

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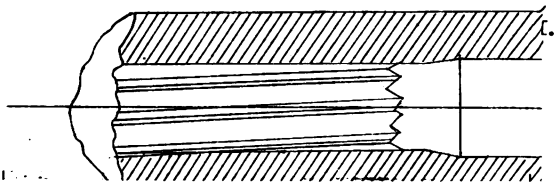
1.



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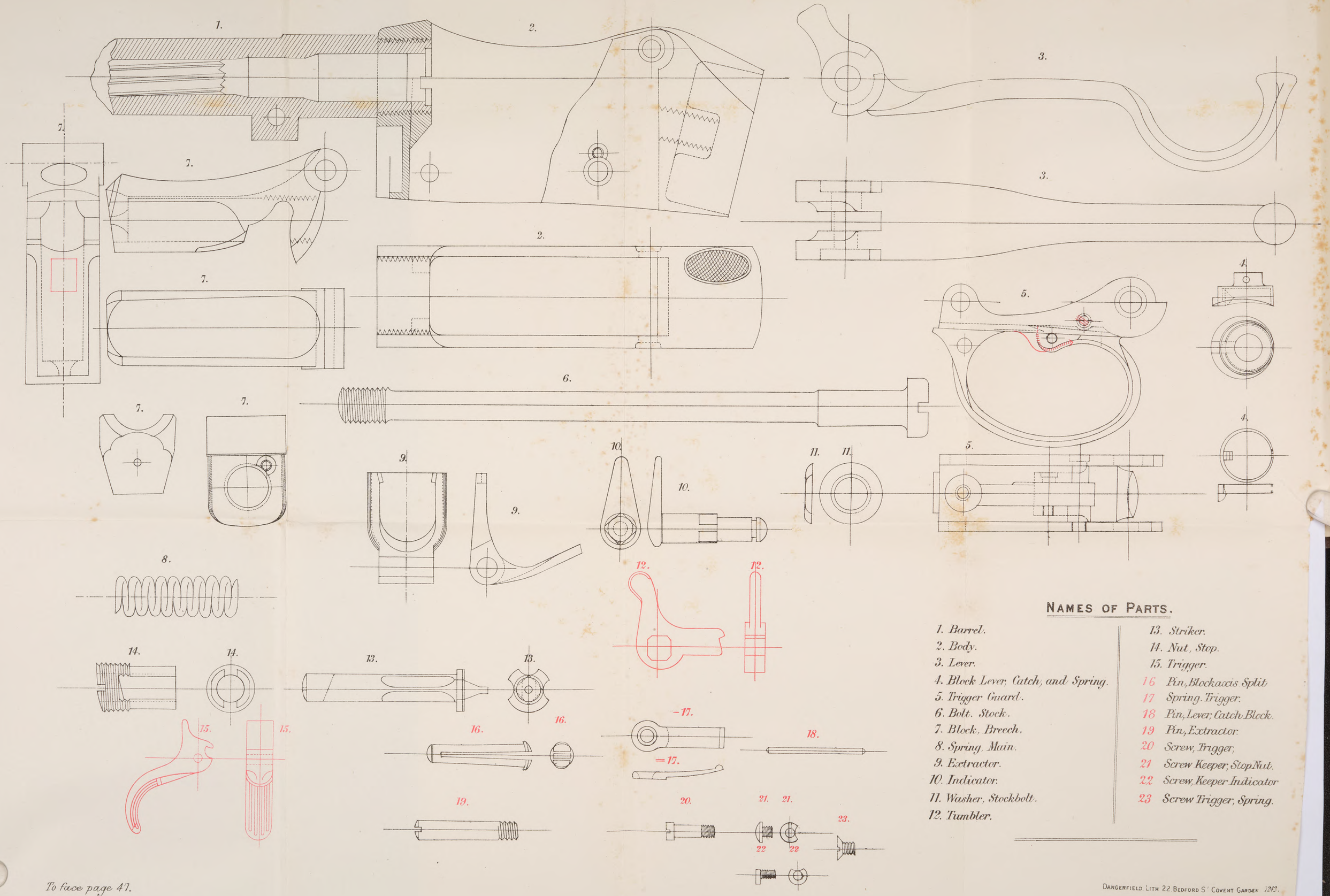
COMPONENT PARTS OF ACTION FOR MARTINI HENRY RIFLE. (MARK II.)

FULL SIZE.

Plate VII.

The Red shews the last alterations.



NAMES OF PARTS.

1. Barrel.
2. Body.
3. Lever.
4. Block Lever, Catch, and Spring.
5. Trigger Guard.
6. Bolt. Stock.
7. Block, Breech.
8. Spring, Main.
9. Extractor.
10. Indicator.
11. Washer, Stockbolt.
12. Tumbler.
13. Striker.
14. Nut, Stop.
15. Trigger.
16. Pin, Blockaxis Split
17. Spring, Trigger.
18. Pin, Lever, Catch Block.
19. Pin, Extractor.
20. Screw, Trigger,
21. Screw Keeper, Stop Nut.
22. Screw, Keeper Indicator
23. Screw Trigger, Spring.

To face page 47.

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CHAPTER III.

SMALL ARMS.

THE MARTINI-HENRY RIFLE (Mark II.).*

DIRECTIONS FOR CLEANING.

1. All parts connected with the breech action should be kept perfectly clean, but all cutting substances, such as emery, sandpaper, &c., are to be strictly avoided in cleaning. The buff stick must not be used to any part of the action. *See* Plate VII.

2. Pass the point of the cleaning-rod through the sight protector and screw on the jag. On no account should the cleaning-rod be put into the barrel without the sight protector being used.

3. Open the breech.

4. Wrap a damp rag, flannel, or tow, round the jag of the cleaning-rod so as to cover it, and rub carefully up and down the barrel to remove the fouling. Water should not be used. Should the rod stick fast in the barrel, it should be driven back by light blows with a wooden mallet, not dragged through the muzzle.

5. The barrel should be thoroughly dried, then wrap round the jag an oiled rag (woollen if possible), and pass it a few times up and down the barrel.

6. Wipe the breech end of the barrel, the interior of the body, and the breech-block, thoroughly with an oiled rag.

7. Close the breech, and ease springs.

8. The action can usually be sufficiently oiled by pouring a few drops of oil through the opening between the lever and the body, when the former is drawn out of the lever catch-block, and the rifle held with the trigger guard uppermost.

9. Special care should be taken not to injure the striker-hole or any portion of the face of the block in cleaning.

10. Rangoon oil only should be used in cleaning the rifle.

11. Oil should be occasionally applied to the following parts of the Martini action:—

Knuckle, and knuckle seat of block.
Axis pin of block.
Lever ends and seat in block.

---

* These instructions relate to arms having the modified components, 1876; for arms of the earlier pattern (Mark I.) the instructions dated August 1875 remain in force.

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Lever, and tumbler axis.
Trigger axis.
Trigger nose and spring.
Extractor axis.
Mainspring, striker.
Stop-nut and tumbler.

To strip the Action.

1. Close the action.
2. Knock out the block axis pin by placing a drift on the slit-head of the pin, first removing any dirt there may be in the slit.
3. Depress lever, and hold down front end of block with left thumb, close the lever, and the block will spring out.
4. Take out block, turn the curve in keeper screw fair with the curve in the stop nut, unscrew the stop nut; the striker and main spring will then fall out.
5. Turn the keeper screw head of lever axis fair with axis hole, press out axis pin, and take out the tumbler.
6. Turn out extractor axis screw, and remove extractor, trigger guard, and lever.
7. Turn out the screw holding the trigger spring, and take out the spring.
8. Turn out axis screw of trigger, take out trigger.

To strip Furniture, Barrel, and Stock.

Furniture.

1. Draw cleaning rod, first turning the rod so that the cam is against the rod-holder. The rod will then draw straight out; and in no case is the rod-head to be pulled with any force away from the barrel.
2. Remove upper band and barrel stud pins.
3. Partly unturn band screws and take off bands. The lower band stop pin should not be removed.
4. Drive fore end of stock off barrel stud at breech end with wood drift.
5. Take off butt plate.

Stock barrel.

6. Turn out stock bolt, and take off butt of stock.
7. Grip barrel in gun-metal clam, the under clam to receive the barrel stud. Unscrew body with breech wrench (in no case should this be attempted without previously removing the extractor).

Note.—The body is never to be unscrewed from the barrel unless it is absolutely necessary.

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To assemble Action, Barrel, Stock, and Furniture.

1. If the body and barrel have been separated, grip barrel in gun-metal clam, screw on body until the flat on the barrel is at right angles to the sides of the body, for which purpose use the breeching square. Barrel.

2. Replace butt of stock, observing that the stock bolt washer is in its place in the stock butt; screw up stock bolt. Stock.

3. Screw on butt plate. Furniture.

4. Slide fore end of stock on barrel stud.

5. Replace bands and turn home band screws.

6. Replace upper band pin.

7. Replace barrel stud pin.

8. Replace cleaning rod. When the rod is in its proper position, the cam is away from the rod-holder.

9. Place trigger in guard, and screw up axis screw. Action.

10. Replace trigger spring, taking care that the nose of the trigger spring is under the trigger; screw in the trigger spring screw.

11. Place lever and tumbler in trigger guard, slide guard with lever and tumbler into the body, and replace axis pin with indicator pointing upwards, in the direction of the block axis pin, and screw round keeper screw head to its proper bedding.

12. Replace extractor and turn in axis screw.

13. Place striker in block and drop in main spring, screw home stop nut, and turn keeper screw head into its bedding.

14. Turn striker round until the wider side of slot is downwards.

15. Place the block in body with the front end lowest; hold the lever with right hand, the thumb pressing the indicator forward, the trigger being pressed back by the fore-finger; press hard on the knuckle of block with the heel of the left hand to force it into its seat; at the same time depress and work the lever to get the tumbler into the slot in the striker.

16. Compress the sides of the block axis pin, preparatory to placing it in the body. Place it in the body.

To replace Components.

Adjustment in loading position.

1. If the block be too high, the bearing surface at *A* of the lever may be depressed by means of a punch to the breadth of the corresponding surface on the tumbler. If Adjustment of breech block.

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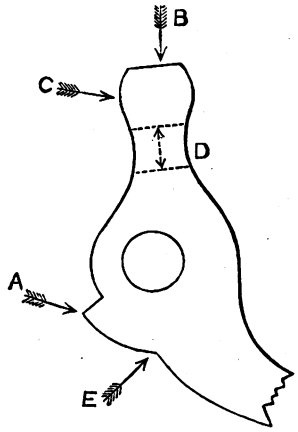
an adjustment of more than ·01 of an inch is required, a new lever should be fitted.

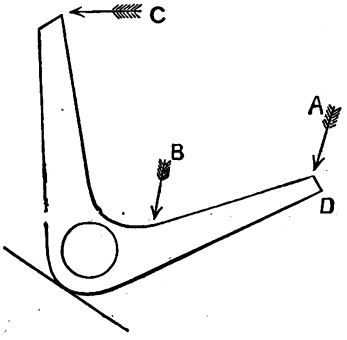


2. Should the block be too *low*, an amount *not to exceed* ·01″ may be *added* to the bearing surface at *A* by carefully drawing out the metal at that point; but should *more than* ·01″ be required (which will rarely, if ever, be the case), a *new* lever should be fitted.

Adjustment in firing position.

1.—When the block is in the firing position, should the striker strike the cap *too high*, an amount not *exceeding* ·01″ *taken off* the bearing surface of the lever horns at *B* will be sufficient to rectify the error.

2. Should the striker strike the cap *too low*, the horns of the lever may be drawn out between the lines indicated at *D* not to exceed ·01″, care being taken not to spread the horns or set them out of position at *C*.



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EXTRACTOR.—When the block is at the loading position the point *A* should be just free from the underside of the block. Extractor.

When the block is depressed to the lowest position it should bear on point *B*, holding the extractor firm; but should the lever at *E* touch the guard so as to prevent the block doing this, the guard may be filed to allow the lever to be clear.

The point *D* should be on the trigger when the extractor is at its lowest position; if it will not bed down, the fault must be looked for on the head of the trigger spring screw; if this stands too high, it should be filed flat.

TRIGGER.—In replacing a trigger, *the nose must not be touched* in making the pull-off, but the adjustment made by *altering the angle of tumbler bent by scraping the face.* Trigger.

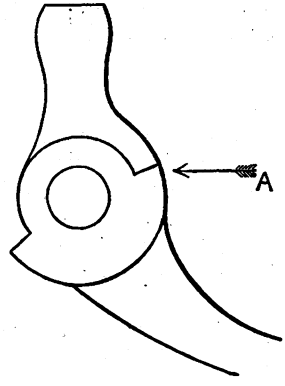
TRIGGER SPRING.—In replacing a trigger spring, care must be taken that the head of the screw beds well down on the spring, and that the point does not bear on the guard swivel screw. Trigger spring.

GUARD.—In replacing guard, it should be placed in the body and the indicator fixed in position—notice that the guard drops freely into the body without side pressure; if the extractor axis hole is not fair in both guard and body, file the nib resting on front of body; if required, run in $\frac{1}{4}''$ tap to regulate the hole, and put in axis screw. See that the indicator is perfectly free to revolve. Guard.

TUMBLER.—In replacing a tumbler, it should *pass firmly* on to, but *not to be driven hard* upon the squares of the axis pin; it should also work freely between the horns of the lever. Tumbler.

INDICATOR.—Remarks same as upon tumbler. Indicator.

LEVER.—In replacing a lever, the bearings at point *A* should be free when the lever is depressed; otherwise it prevents the block from having its *full fall.* Lever.



The end of the lever must be set to drop freely into the lever catch block; care must also be taken that the lever beds on its seat at the under side of socket end of body.

The levers issued with the spare parts are for short butts—they will require setting for long butts

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—a slight blow with a mallet is all that is required to make them drop freely into the lever catch block; the levers for short butts are issued in preference to levers for long butts, as the adjustment required by the former to fit them to long butts is more simple than to adjust a lever for a long butt to a short butt.

Striker.

STRIKER.—When replacing, care must be taken that the larger part of the slot is downwards.

EXAMINATION OF STRIKER.—For this purpose a service cartridge will be prepared as follows:—Remove the bullet, wad, &c., from a service cartridge, and shake out the powder. Place the empty case in a rifle and explode the cap. File the empty case through at $1\frac{1}{4}$ inches from the base disc, taking care not to deform the case. Place inside the empty case, so prepared, a small cylinder of wood, in order to prevent it becoming dented, and fasten it in case by punching two or three small holes round the edge. Fill the indentation in the exploded cap with soap, level with the base disc.

To test the condition of the point of the striker:—Load the rifle with a dummy cartridge and fire. On withdrawing the cartridge an impression of the point of the striker will be found in the soap should the striker be perfect. Should the striker make no impression in the soap when the rifle is fired, the point of striker must be broken, and the fact should be at once reported.

Stock.

STOCK.—To replace a stock the butt plate must be removed, the stock bolt unscrewed, and washer removed. Should the new stock not be drawn firmly home when the bolt is screwed up, a second washer must be put on. Should the point of the stock bolt protrude on the inside of the body, it will interfere with the full play of the block when extracting; additional washers may require to be added in a soft sap stock to prevent this.

Easing springs.

EASING SPRINGS.—The action being open, place the thumb on the thumb seat, and the forefinger on the trigger, the remaining fingers under the guard, press the trigger firmly without touching the lever, and when the lever is closed* secure it in the catch by clasping the bow of the lever and small of the butt with the right hand.

N.B.—"Springs must never be eased when a cartridge is in the chamber."

* If the lever should fail to close on pulling the trigger, this indicates that the action is not in good order, and the lever must be then pressed home by the right hand.

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When a spare part which bears *a date of manufacture* is placed in a rifle, the date on which this spare part is so used is to be placed by the Armourer near the *S* which will be found on the spare part.

To ADJUST "PULL-OFF."—Assemble the guard with tumbler, lever, and assembled block in action—regulate the "pull-off" by the bent from 2 to 2½ lbs., without the trigger spring. Insert trigger spring and bring the "pull-off" to the regulation weight (6 to 8 lbs.) by filing the underside of spring if too heavy or putting in a stronger spring if too light, particular care being taken to see that the spring is screwed hard and firmly down by the screw. Pull off.

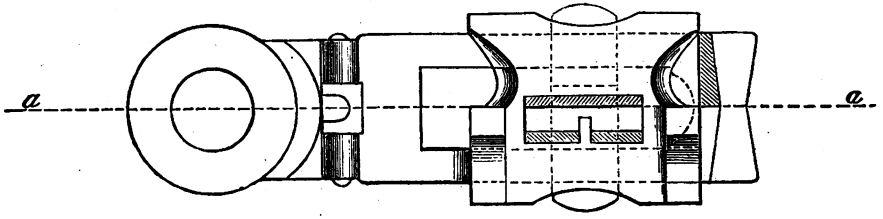
(In replacing a trigger spring, the "pull-off" must be adjusted in the manner above described.)

GAUGE ACTION.—The "gauge action" is issued solely for the purpose of testing the component or components of any rifle which may appear to be defective in its action. For this purpose the component parts of the action of the rifle may be assembled in the "gauge action," when the working can be clearly seen and the defective part (if any) noticed. Gauge action.

Should there be any doubt as to which component is in fault, it can be set at rest by substituting for the suspected component the corresponding one from the "gauge action," which, being of correct form, should work well if the other components are in good order. Great care should be taken, in using the "gauge action" or any of its components, not to strain or distort them.

TO RENEW LINES ON SIGHT SLIDES AND CAPS.

Fit the sight-line tool over the slide and leaf, and press it up to the cap, then with a scriber, having a point of the proper width, re-mark the windage and centre lines on the slide and cap, as shown by the dotted lines *a a* in sketch. Reverse the tool and re-mark the opposite windage line, and trace over the centre lines *a a*, to prove that they are in the centre, as there is a slight variation in the width of the leaves. Lines on sights.



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Instructions for using Trigger Testers.

Pull-off.

1. The "pull-off" of military small arms is regulated so as to require a mean weight of about 7 lbs. to be applied to the finger-piece of the trigger, in order to release the trigger nose from the bent in the tumbler; this result is obtained only when the components of the action, including the trigger, are perfectly clean and freed from dried-up oil or other matter causing obstruction to the free working of the various parts.

In order, therefore, to obtain trustworthy indications of the weight of the "pull-off," the armourer will thoroughly examine the actions of the arms which are to be tested, and clean and oil such as he finds require to be so treated, especial attention being paid to the following points, viz., that the block does not jam against the end of the breech when it is being closed, that the indicator is not bound by the guard, but works freely, and that the trigger screw is screwed well home.

Regulation of pull-off.

2. Should the action, after having been thoroughly examined, cleaned, and oiled, be found to pull-off either light or heavy (*i.e.*, below 6 lbs. or over 8 lbs.), it may be easily regulated according to instructions for adjusting "pull-off," page 47.

Method of weighing pull-off.

3. In weighing the "pull-off" the arm should be rigidly held (if possible, in a vice), in a horizontal position, the indicator side uppermost. The trigger-tester should be held in a line diagonally across the grip, and immediately over the lower corner of the body.

To replace, on Service, Strikers and Mainsprings.

1. The following are the instructions for replacing, in the absence of armourers' tools, strikers and mainsprings of Martini-Henry rifles, using for the purpose the sword bayonet, and the "implement action."

2. Place the muzzle on the ground, and the butt underneath the right arm. With the drift of the implement knock out the block axis pin by striking the top of the former with the pommel of the sword bayonet, using the spring side.

3. Take out the block, and with a small screw-driver turn the keeper screw fair for the stop nut, with the stop nut screw-driver take out the stop nut. Renew the striker or mainspring, and re-assemble the block.

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4. Place the assembled block in the body, and with the hook and jaw of the implement compress the sides of the block axis pin, at about one-eighth of an inch from the divided end.

Insert the pin in the axis hole, and drive it home with the head of the implement.

Whenever a party armed with rifles is sent away from the ship without an armourer, an "implement action" and a proportion of spare mainsprings and strikers are to be always taken and considered in charge of one of the petty officers :—

Spare gear to be taken on service.

Mainsprings, 1 for every 10 rifles.
Strikers, 1 for every 5 rifles.

ADAM'S PISTOL.

Directions for taking to pieces.

To remove the Cylinder.

1st. Half cock.
2nd. Press in base-pin spring.
3rd. Remove base-pin and cylinder will fall out, by turning the pistol on one side.

To remove Trigger Guard and Spring.

Take out screws and remove guard, the trigger spring will then fall out.

To remove the Butt.

Take out strap screws, the butt or stock will then be free.

To remove Mainspring.

Place point of screw-driver under lower or short limb, and press gently upwards, the spring will then fall off.

To remove Sear Spring.

Hold the muzzle upward and the sear spring will fall off.

To remove the Hammer.

Take out hammer screw.

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To remove Trigger.

Take out trigger screws. The cylinder lifter has only to be disengaged from trigger.

To remove Short Sear.

Take out sear screw and sear will fall out.
The parts may be replaced by commencing at the last-named part.

TRANTER'S PISTOL.

DIRECTIONS FOR TAKING TO PIECES.

To remove Cylinder.

Half cock and withdraw cylinder axis.

To remove Stock.

Take out lower strap screws.

To remove Mainspring and Sear.

Press spring to the right with forefinger and thumb, and remove mainspring. The sear spring will then fall out.

To remove Side Plate and Hammer.

Take out hammer screws and front plate screws, and remove side plate. The hammer may be then removed.

To remove Guard.

Same as Adam's pistol.

To remove Sear.

As in Adam's.

To remove Trigger.

As in Adam's.

To take out Trigger Spring.

Press gently up with the small screw-driver.
The parts are replaced in reverse order to above.

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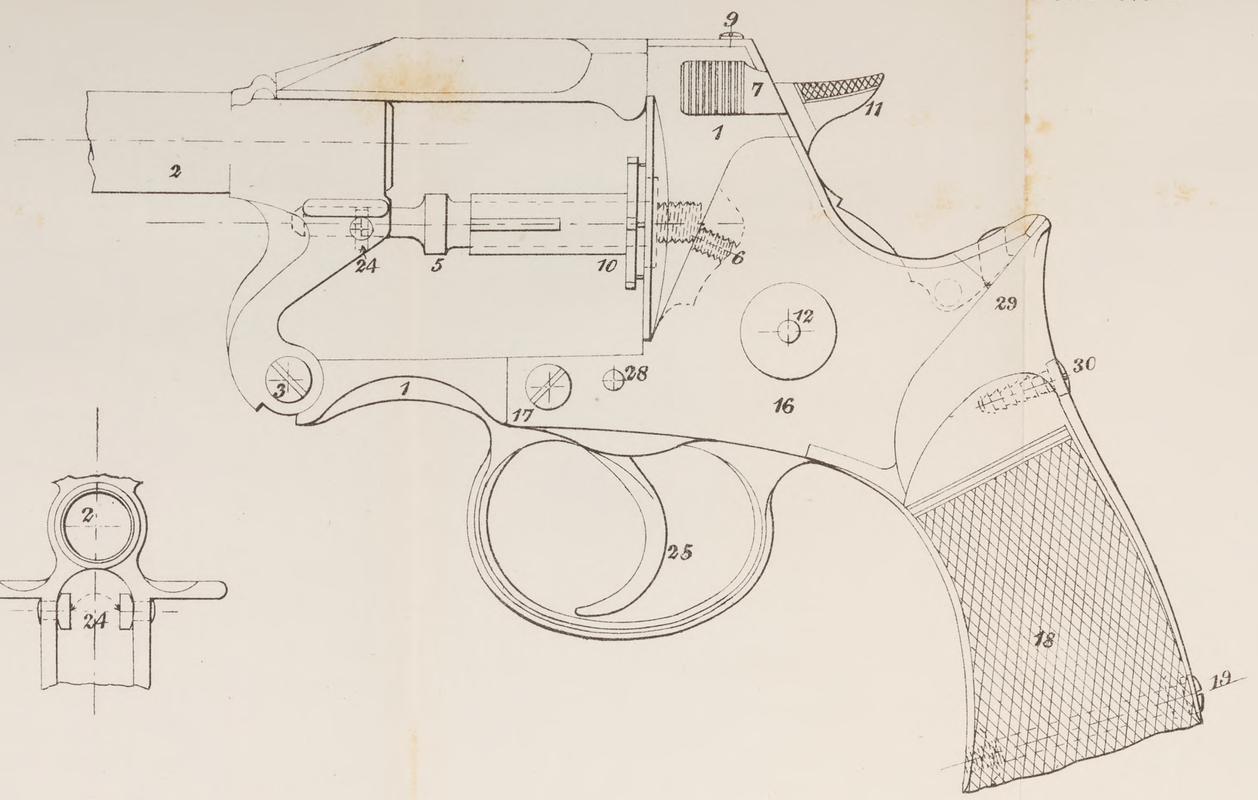
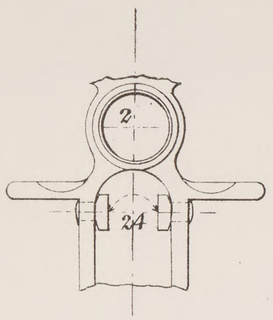
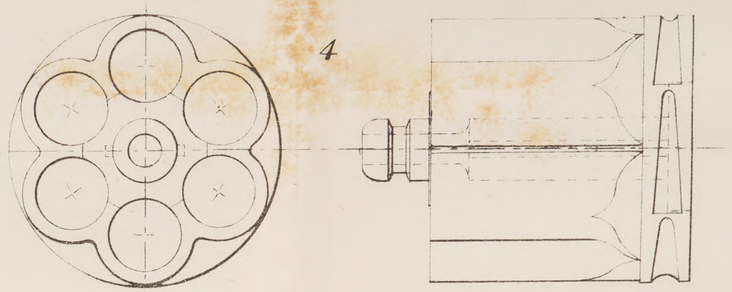
ENFIELD REVOLVER PISTOL MARK I.

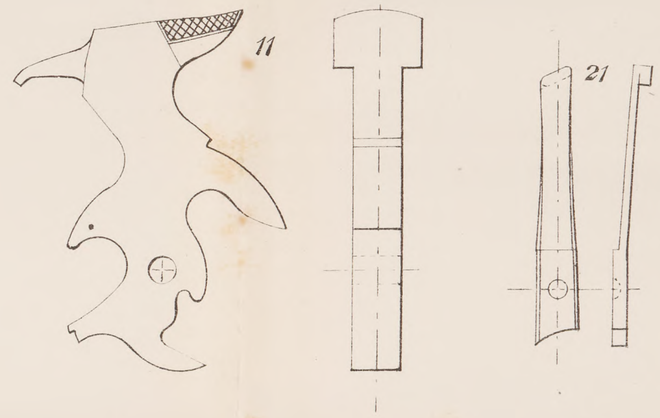
COMPONENT PARTS.

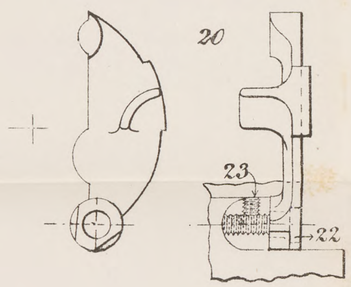
FULL SIZE.

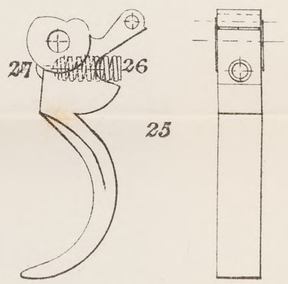


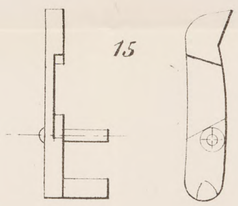


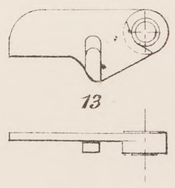


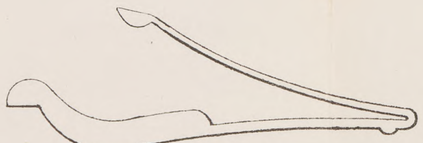


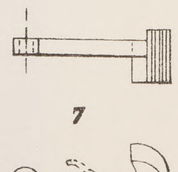


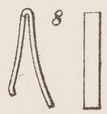


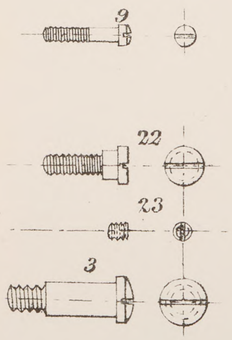


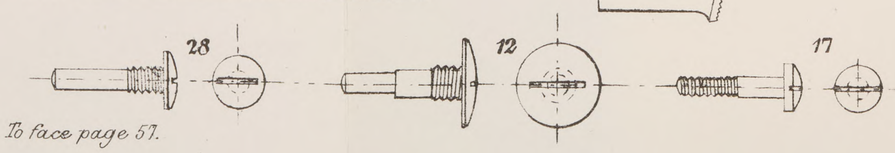












To face page 51.

NOMENCLATURE OF COMPONENTS.			
1	Body	16	Plate
2	Barrel	17	,, screw
3	,, joint screw	18	Stock
4	Cylinder	19	,, screw
5	,, axis	20	Shield
6	,, ,, keeper screw	21	,, spring
7	Catch	22	,, screw
8	,, spring	23	,, ,, keeper screw
9	,, screw	24	Swivel studs
10	Extractor	25	Trigger
11	Hammer	26	,, spring
12	,, axis screw	27	,, ,, rivet
13	Lever	28	,, axis screw
14	Main spring	29	Top strap
15	Pawl	30	,, ,, screw

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PISTOLS, REVOLVER, B.L., ENFIELD (MARK I. AND II.).

General Instructions.

All parts of the pistols will be kept perfectly clean. Oil only will be used for this purpose; the use of cutting substances, such as emery, sand-paper, &c., is strictly forbidden.

When the cylinder is being cleaned after firing, it should not be taken off the cylinder axis.

The nomenclature and parts of the pistols are shown in the annexed drawings.

Directions for Stripping (Mark I.).

See Plate VIII.

1. Unscrew the stock screw, lift off the stock with the top strap attached. Unscrew the top strap screw, and take the top strap out of the stock.
2. Unscrew the plate screw, place a screw-driver in the groove in the under-side end of plate, and prise up the plate slightly; do the same on the opposite end from the inside of the action, and lift off the plate.
3. Full cock the hammer, and press the fork of the cramp of the implement over the mainspring, release the trigger, and take out the mainspring.
4. Draw the pawl out of the slot, and lift the trigger off its axis (the trigger axis is screwed in with *right* hand thread). Lift the hammer and the lever off the axis.
5. Take out the barrel joint screw, take off the barrel and draw off the cylinder.
6. The cylinder axis keeper-screw should be unscrewed 3 or 4 turns from the inside after the hammer is taken out, no attempt must be made to move the cylinder axis until this has been done. The axis is screwed in by a *left* hand thread, and to unscrew this hold the pistol in the left hand, with the trigger guard towards you; slip the hole in the screw-driver over the end of the axis, and the projecting lugs into the grooves in the collar; press towards you, and repeat this until the axis can be turned with the fingers. Draw out the catch screw and the catch, taking care not to lose the catch spring.
7. With the punch drive out the shield spring, taking care that the shield depresses the spring at the same time.
8. Take out the shield screw keeper-screw.
9. Take out the shield screw.

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Directions for Assembling (Mark I.).

1. Replace the extractor properly on the axis, and screw the latter into the body, turning the screw from right to left, tighten up home with the screw-driver as used in stripping.

2. Screw home the axis keeper-screw, taking care to raise no burr to impede the free play of the hammer.

3. Replace the shield spring by driving home in the dovetail.

4. Replace the shield, pressing it down while screwing in the axis screw.

5. Replace the shield screw keeper-screw.

6. Replace the hammer on the axis, taking care that it is quite free and will drop with its own weight. (This axis is screwed in with a *left*-hand thread.)

7. Place the lever on the same axis, and let the hammer drop down home.

8. Place the pawl in the trigger and replace the trigger on its axis, taking care to hold the pawl back to clear the slot when over the lever; press the pawl into the slot, taking care that the trigger arm is above the hammer.

9. Replace the mainspring, pull the hammer to full cock and take off cramp.

10. Oil the action.

11. Replace the plate and screw in the plate screw.

12. Replace the top strap and the screw.

13. Place the break-off of stock in the body; press home and screw in the stock screw.

14. Slide the cylinder on the extractor; first placing the swivel-studs in the barrel arm properly in the groove of the cylinder nozzle; joint up and replace the barrel joint screw.

15. Replace the catch spring and slide catch with the spring into the body; replace the catch screw.

Directions for Stripping (Mark II.).

1. Unscrew the cap-stock screw with eye, and remove the stock.

See Plate IX. 2. Unscrew the two plate screws, and take off the plate, as directed for Mark I.

3.
4.
5. } As directed for Mark I.
6.

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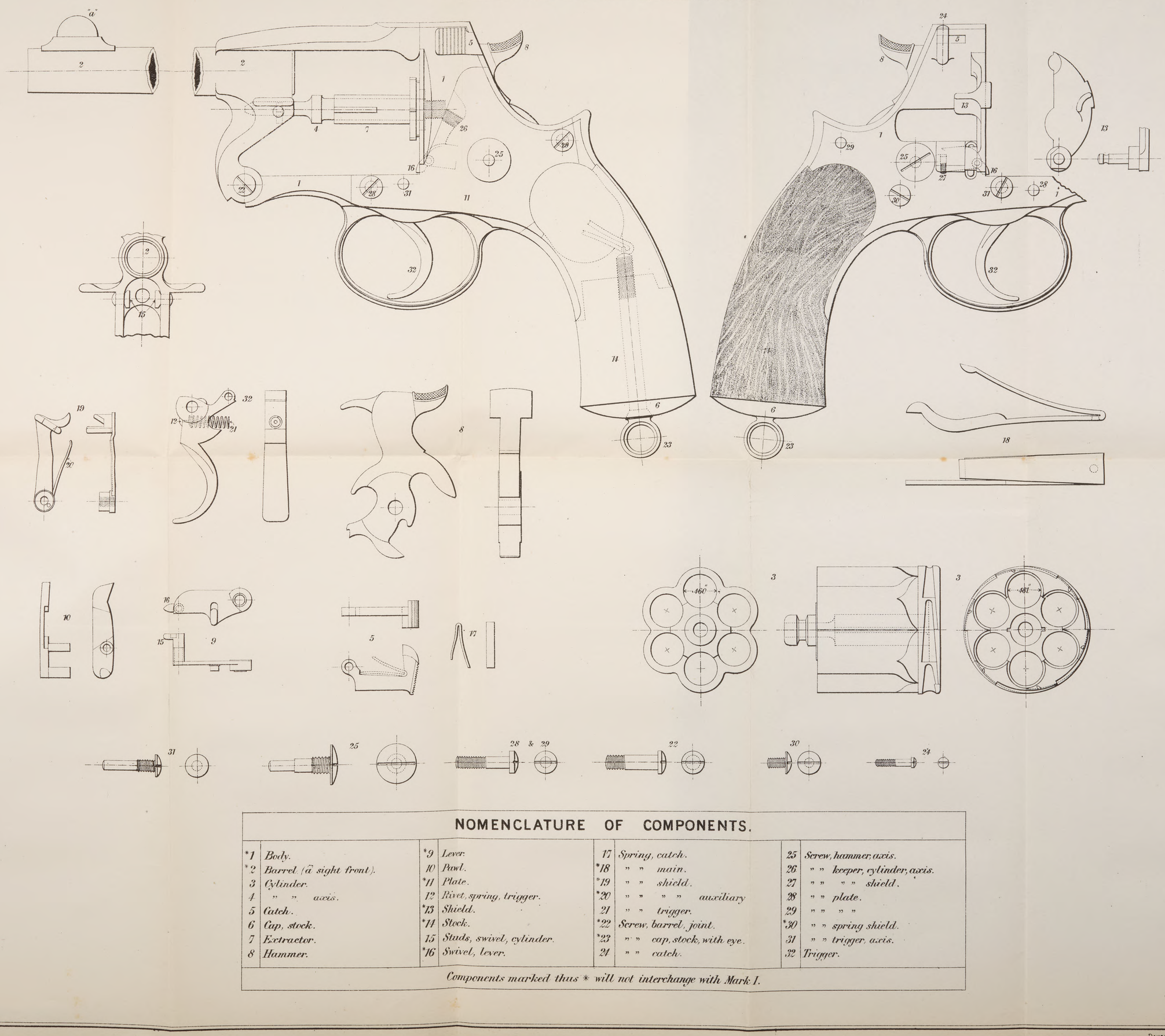
ENFIELD REVOLVER PISTOL, MARK II.

COMPONENT PARTS.

FULL SIZE.



NOMENCLATURE OF COMPONENTS.

*1	Body.	*9	Lever.	17	Spring, catch.	25	Screw, hammer, axis.
*2	Barrel (a sight front).	10	Pawl.	*18	" " main.	26	" " keeper, cylinder, axis.
3	Cylinder.	*11	Plate.	*19	" " shield.	27	" " " " shield.
4	" " axis.	12	Rivet, spring, trigger.	*20	" " " " auxiliary	28	" " plate.
5	Catch.	*13	Shield.	21	" " trigger.	29	" " " "
6	Cap, stock.	*14	Stock.	*22	Screw, barrel, joint.	*30	" " spring shield.
7	Extractor.	15	Studs, swivel, cylinder.	*23	" " cap, stock, with eye.	31	" " trigger, axis.
8	Hammer.	*16	Swivel, lever.	24	" " catch.	32	Trigger.

*Components marked thus * will not interchange with Mark I.*

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7. Unscrew the shield-spring screw, and remove the shield spring with auxiliary spring attached.
8. Take out the shield-keeper screw.
9. There is no shield screw in Mark II.

Directions for Assembling (Mark II.).

1. } As directed for Mark I.
2. }

3. Replace the shield-spring with the auxiliary spring attached, and screw home; taking care that the auxiliary spring is in its seat.
4. Replace the shield.
5. Replace the shield-keeper screw.
6. As directed for Mark I.
7. As directed for Mark I., but taking care that the lever swivel drops into its seat on the shield spring.

8. }
9. } As directed for Mark I.
10. }

11. Replace the plate, and screw in the two-plate screws.
12. There is no top strap in Mark II.
13. Replace stock, and screw home the cap-stock screw with eye.

14. } As directed for Mark I.
15. }

List of Components, showing which are special for each Pistol or common to both.

Axis, cylinder, Mark I. and II.
Caps, stock, Mark I. and II.
Catch, Mark I. and II.
Extractor, Mark I. and II.
Hammer, Mark I.
„ Mark II.
Lever, Mark I.
Lever with swivel, Mark II.
Pawl, Mark I. and II.
Rivet, spring, trigger, Mark I. and II.
Screws:
Cap, stock, with eye, Mark I.
„ „ „ Mark II.
Catch, Mark I. and Mark II.
Hammer axis, Mark I. and II.
Joint, barrel, Mark I.
„ „ Mark II.

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Keeper, cylinder, axis, Mark I. and II.
„ shield, Mark I. and II.
Plate, Mark I. and II.
Shield, Mark I. only.
Spring, shield, Mark II. only.
Stock, Mark I. only.
Strap, top, Mark I. only.
Trigger, axis, Mark I. and II.
Sights, front, barley corn, Mark I.
„ „ „ Mark II.
Springs:
Catch, Mark I. and II.
Main, Mark I.
„ Mark II.
Shield, Mark I.
Shield, with auxiliary spring, Mark II.
Trigger, Mark I. and II.
Stock, Mark I.
„ Mark II.
Studs, swivel, cylinder, Mark I. and II.
Trigger, Mark I. and II.

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HYDRAULIC LIFTING JACK.

WEIGHT 89 LBS.
TONNAGE ·017 TONS.

FIG 1
VERTICAL SECTION THROUGH Y.Z.
(¼ FULL SIZE.)

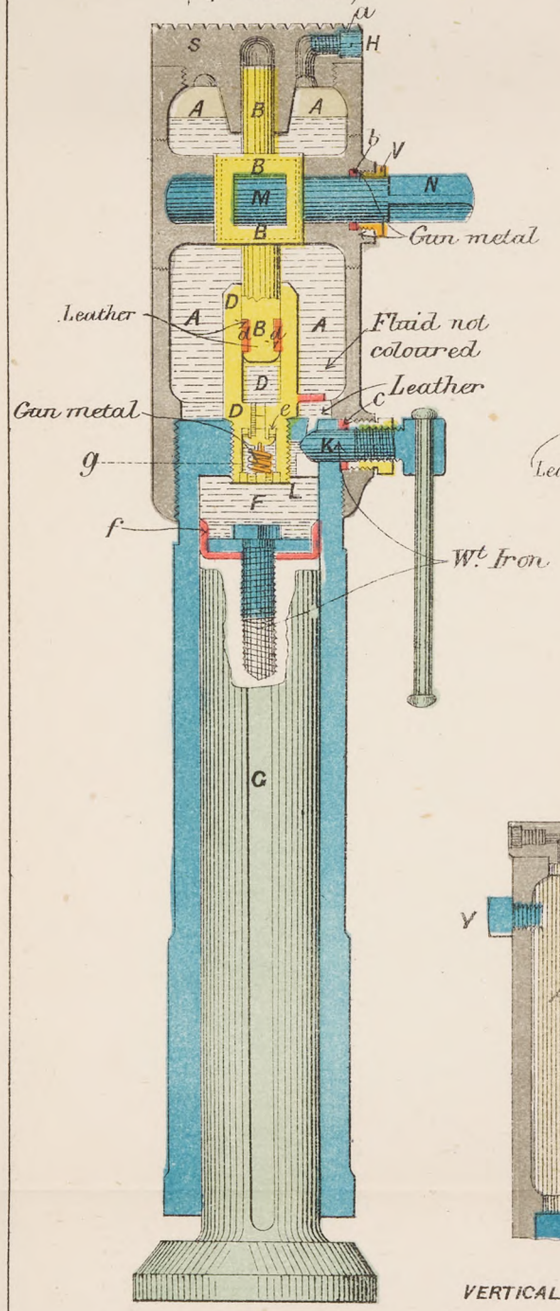


FIG 2.
VERTICAL SECTION OF PUMP D.
(½ FULL SIZE)

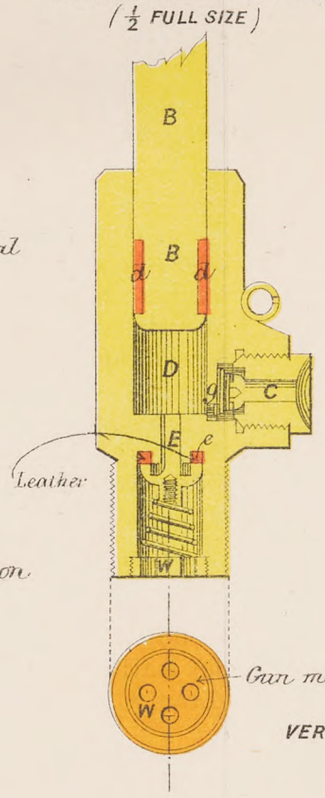


FIG 3.
SIDE ELEVATION OF PUMP D
(½ FULL SIZE.)

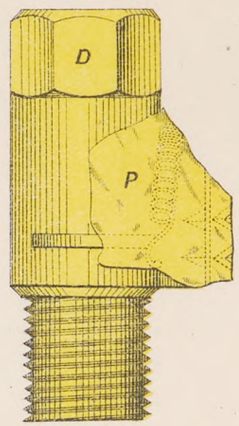
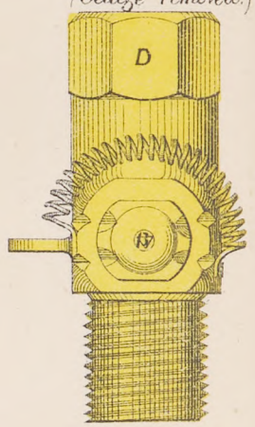


FIG 4.
FRONT ELEVATION OF PUMP D
(½ FULL SIZE.)
(Gauze removed.)



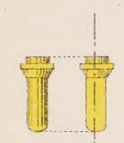


FIG 7.
INLET VALVE C.
(½ SIZE.)

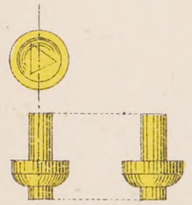


FIG 8.
OUTLET VALVE E.
(½ SIZE.)

FIG 5.
SIDE ELEVATION OF JACK
(¼ FULL SIZE.)

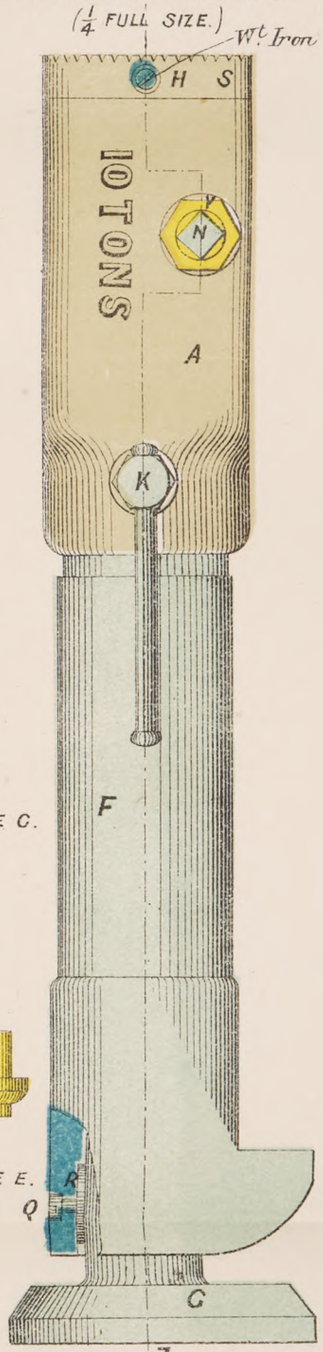
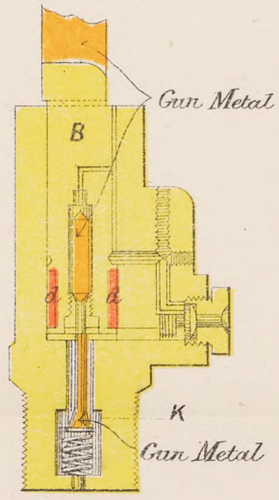


FIG 6.
LEVER
(¼ FULL SIZE)

FIG 10
VERTICAL SECTION OF PUMP.
(½ SIZE.)



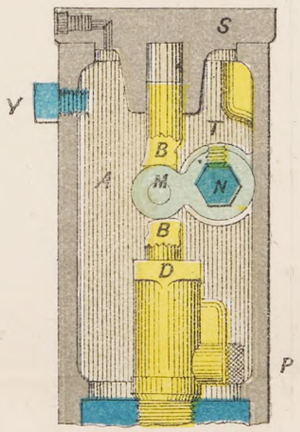


FIG 9.
VERTICAL SECTION OF RESERVOIR A.
(¼ FULL SIZE.)

NOMENCLATURE OF THE VARIOUS PARTS

A. Reservoir.
B. Plunger
C. Valve, Inlet.
D. Pump.
E. Valve, Outlet.
F. Cylinder.
G. Ram.
H. Plug, Screw, Air.
K. Plug Screw, Lowering.
L. Passage, Lowering.
M. Crank.
N. Spindle, Crank.
O. Lever.
P. Covering, Gauze, Wire.
Q. Screw for Feather.
R. Feather.
S. Cap.
T. Screw, Set, Crank.
V. Gland, Packing, Crank, Spindle,
W. Plug, Screw, Pump.
X. Gland, Packing, Screw, Plug Low?
g. Springs, Valve.

LEATHER PACKINGS

a. Plug, Screw, Air.
b. Spindle, Crank.
c. Plug, Screw, Lowering
d. Plunger.
e. Valve, Outlet.
f. Ram.

SKETCHES SHEWING INSIDE LOWERING ARRANGEMENT.

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CHAPTER IV.

HYDRAULIC JACKS.

Instructions for use.

The hydraulic jacks in use in the navy are of two descriptions, viz., vertical and angular. Jacks in use in the Navy.

The vertical jacks are respectively capable of lifting the following weights:— Plate X.

Tons.	Tons.	Tons.
40	20	9
30	15	6
25	12	4

The angular jacks can severally raise:

30 tons.
25 „
20 „

Jacks are also issued in connexion with the gun carriages.

Fresh water is to be used on ordinary occasions, and the addition of a little soft soap or washing soda will cause them to work well, and will keep the packing, &c., in good order. Soap or soda recommended.

When it is probable that the temperature will be sufficiently cold to freeze the water, rum, in the proportion of one of spirit to two of water, is to be mixed with the water. Rum to be used in cold weather.

To keep the Jack ready for work.

Pump it up once a week, clean and oil the ram. To keep in working order.

The jack should always be left with some pressure in it, to preserve the leather packing *f* on the end of the ram. To do this the ram G should not be run quite down.

To charge the Jack.

First take care the ram is quite home, then fill the cistern with clean water. Charging.

If the valves fail from disuse, screw up the lowering screw tight, then stand upon the base, and pull the cylinder up from the ram, this will cause a rush of water through the pump and so cleanse it.

To prepare for Transportation.

The screw plug K is loosened to allow of the lowering of the cylinder over the ram G, by which means the liquid Transporting.

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is collected in the reservoir A; the plug H is then tightly screwed up, and the jack is ready for transport.

To raise a Load.

Raising load.

The screw plug H is loosened to allow of the entrance of air, and K is tightened; the lever O is shipped and worked up and down, its action on the pump being as follows:—

The lever acts upon the crank M through the spindle N, and by its means raises and lowers the plunger B; in the up stroke a vacuum is created in the pump, and the pressure of the air on the liquid in A forces it through the inlet valve C; at the down stroke the inlet valve closes and the outlet one E opens, and allows of the liquid being forced past it on the top of the ram G, thus raising the cylinder and with it the load on the cap S.

The jack is at its full height when the water comes out of the small hole behind the claw.

To lower the Load.

Lowering.

The screw plug K is loosened, which allows the liquid in the cylinder to pass through the passage L to the reservoir A.

Parts liable to get out of Order.

Leather packings.

The parts most likely to get out of order are the leather packings; those marked *a*, *b*, *c*, and *f* would cause the jack to leak externally, and any disorder in them can easily be detected, and the packings replaced with new; those marked *d* and *e* would injure the lifting power, and would necessitate the taking to pieces of the jack and its careful examination.

To get at the leather packing *f*, release the feather R, which will allow of the removal of the ram G.

Three complete sets of spare washers are supplied for each jack.

P is a gauze wire covering placed over the inlet valve C, to prevent the ingress of dirt; this valve, having a metallic seating, is little liable to derangement.

Examination of pump.

To get at the pump the cap S is turned off, the screw T taken out and the packing gland V unscrewed, when the spindle M and the plunger B are free to be removed; the pump D is then turned to the left, and when taken out the plug W is unscrewed; the outlet valve E may then be examined.

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JACK, LIFTING, HYDRAULIC, REAR ROLLER, WITH PUMP AND RELEASE, LEVER, CARRIAGE, WROUGHT IRON.
R. M. L. TURRET, 12 INCH 35 TONS, TO 10 INCH, ALSO GARRISON, 12·5 INCH AND 12 INCH 35 TONS.

FIG 1.
REAR ELEVATION OF JACK

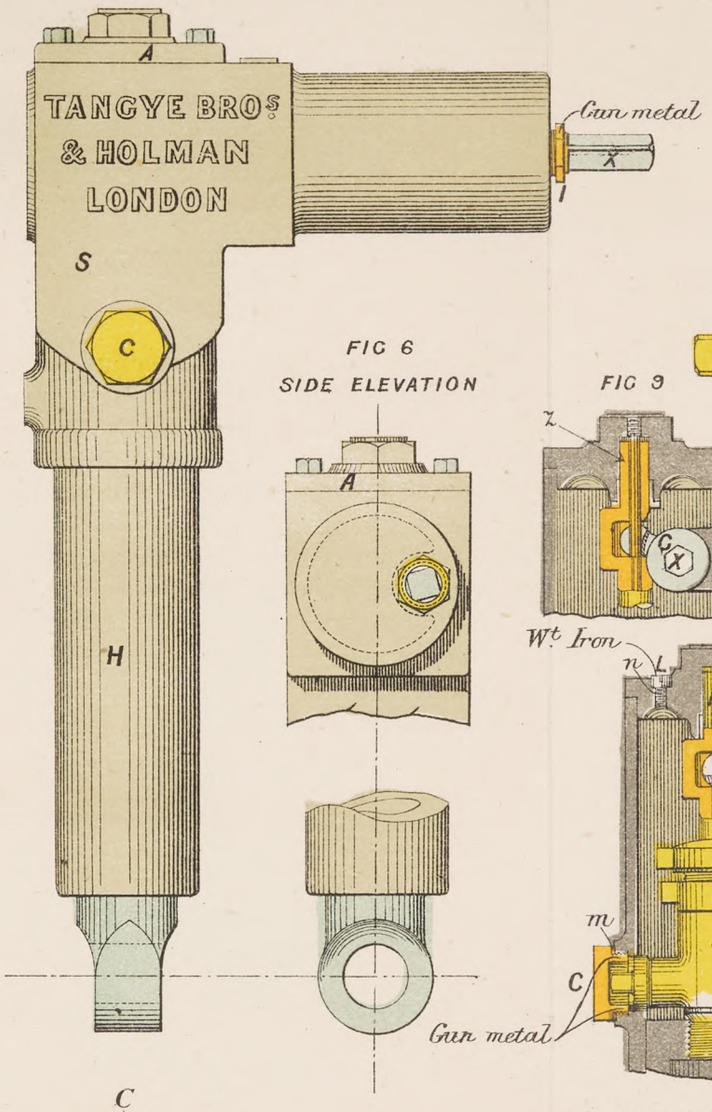


FIG 6
SIDE ELEVATION

FIG 2.
VERTICAL SECTION OF PUMP & PLUNGER

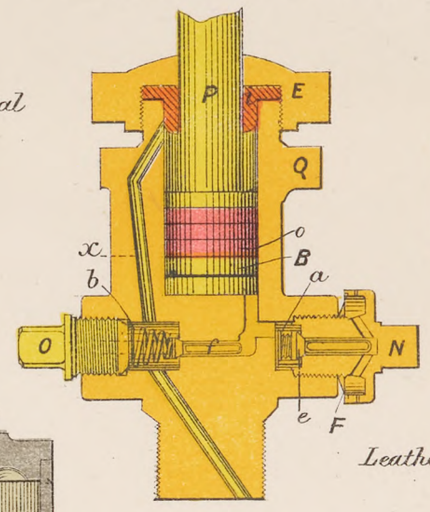


FIG 3.

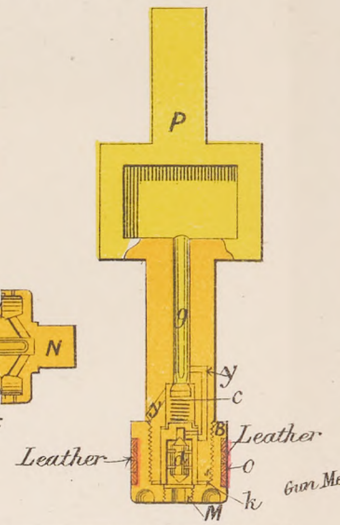
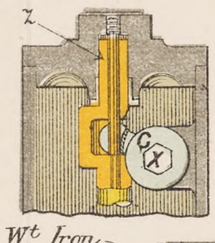
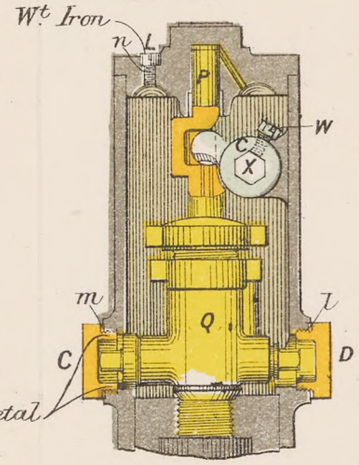
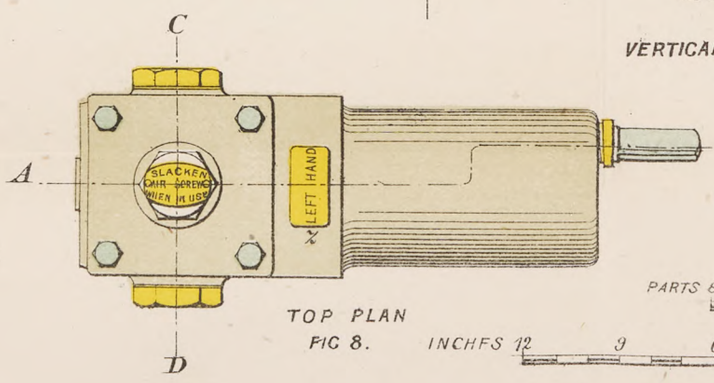


FIG 9





VERTICAL SECTION ON C.D
FIG 7.



TOP PLAN
FIG 8.

RIGHT HAND TURRET

INSCRIPTION PLATE
To be placed at (7) on Jack for right hand turret carriage.

NOMENCLATURE OF THE VARIOUS PARTS

A. Cap, jack, reservoir
B. " packing, plunger.
C. " reservoir, valve, inlet.
D. " " outlet.
E. " screw pump.
F. Covering, valve inlet, wire gauze.
G. Crank
H. Cylinder
I. Gland, packing, crank spindle.
K. Lever.
L. Plug, air, screw
M. " cap, packing, plunger.
N. " pump, valve, inlet.
O. " " outlet.
P. Plunger.
Q. Pump.
R. Ram.
S. Reservoir.
T. Screw, cap, reservoir.
V. " ram.
W. " set, crank.
X. Spindle, crank.
a. Spring, valve, inlet.
b. " " outlet.
c. " " release.
d. Valve, equilibrium.
e. " inlet.
f. " outlet.
g. " release.
h. Washer, ram.

LEATHER PACKINGS.

i. Cap, pump.
k. " plunger
l. " reservoir, valve, inlet.
m. " " outlet.
n. Plug, air, screw.
o. Plunger.
p. Ram.
q. Spindle, crank.

FIG 4.
VERTICAL SECTION ON A.B.

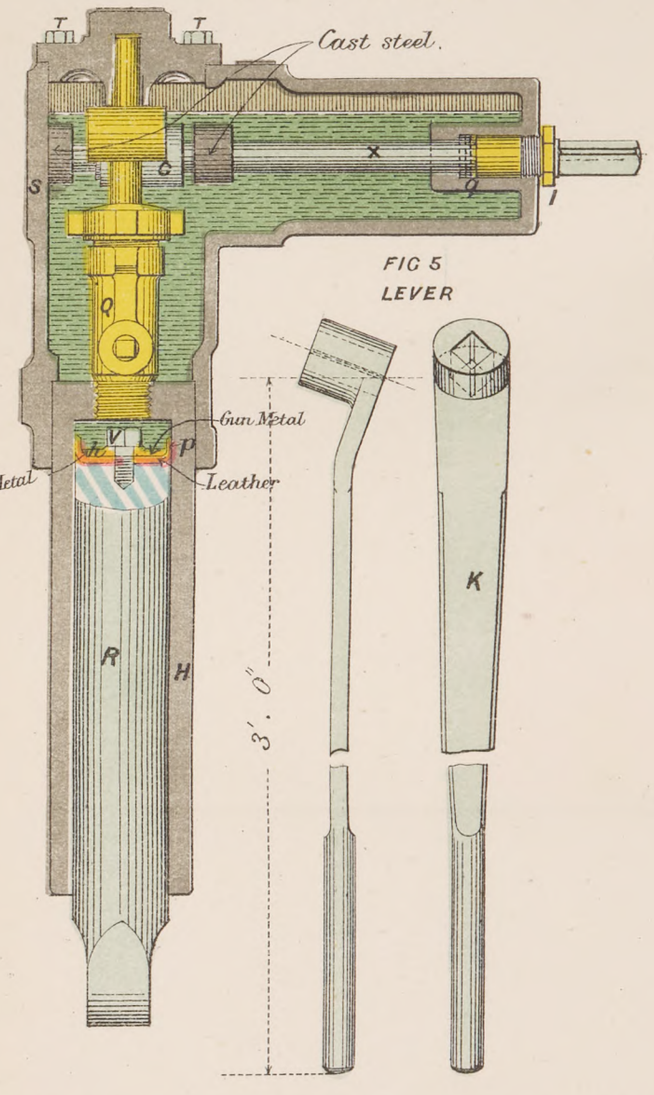


FIG 5
LEVER

	WEIGHT	TONNAGE	APPROVED	PARAGRAPH LIST OF CHANGES
	Cwt. qr lb	Tons		
Jack Complete	1. 2. 7	0·079	22 1. 72 57/2/434	2223

Wrought Iron
Cast Steel
Gun Metal
Leather

SCALE OF FIGS 2 & 3.
PARTS 8 6 4 2 0 1 2 3 4 5 6 7 8 9 10 11 INCHES

SCALE OF FIGS 1, 4, 5, 6, 7, 8, & 9.
INCHES 12 9 6 3 0 1 2 FEET

To face page 63.

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Jacks of the latest pattern have the lowering valve K placed at the bottom of the pump D, and a filling hole with screw plug Y at the side of the reservoir A, see Figs. 9 and 10. The above instructions and description are suitable for this jack except for lowering. To lower the load the lever O must be drawn partially off the spindle N until it can pass the stop on the side of the reservoir, and on being forced down the plunger B opens the valve K′, and allows the liquid in the cylinder to pass through the pump to the reservoir A by the passage shown in Fig. 10. New patterns.

Jack Lifting Hydraulic Rear Roller with Pump and Release Lever Carriage, Wrought-Iron R.M. and Turret 12-inch, 35 tons, to 10-inch.

Instructions and Description.

Plate XI.

1. *Care of the Jack.*

The jack is filled with a mixture of water and methylated spirit, in the proportion of two of the former to one of the latter, to which has been added 1 oz. of common soda to the gallon. The mixture must be filtered into the jack through the filter, tin, jack, lifting, hydraulic (§ 3794, List of Changes).

The jack must be cleaned out every three months, and the mixture passed through the filter when returned to the reservoir.

The jack should be worked occasionally to keep the packings in good order.

If, from want of methylated spirit, it becomes necessary to use water only, and the weather is very cold, care should be taken to prevent the water freezing.

The capacity of the jack is four quarts.

The jack should always be left with some pressure in it to preserve the leather packings.

2. *Prepared for Transportation.*

The screw plug L is loosened, to allow the air to escape, and the valve *g* opened (*see* clause 4), by which means the liquid is collected in the reservoir S; the plug L is then screwed down tightly, and the valve *g* allowed to close.

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3. *To raise the Carriage on its Rollers.*

The screw plug L is loosened to allow of the entrance of air; the lever K is shipped, handle downwards, and worked backwards and forwards, its action on the pump being as follows:—

The lever K acts upon the crank G through the spindle X, and by its means raises and lowers the plunger P. In the up stroke a vacuum is created in the pump Q, and the pressure of the air on the liquid in the reservoir S forces it through the inlet valve *e* into the pump Q; at the down stroke the inlet valve *e* closes, and the outlet valve *f* opens, and allows of part of the liquid being forced to the top of the ram R, and part passing by the passage *x* to the top of the plunger. In the next up stroke the plunger P, in addition to creating a vacuum under it, forces the liquid already above it through the passage *x* on to the top of the ram.

4. *To Lower the Load.**

The lever K is pressed towards the rear, until the crank G presses open the release valve *g*, and allows the fluid to pass back to the reservoir from the top of the ram.

If it is required to "lower" when the plunger is at the end of the up stroke, press the lever slowly towards the rear, this will allow the equilibrium valve *d* to open, and the liquid to pass back to the reservoir S through the passages *y*.

5. *Parts liable to get out of Order.*

The parts most liable to get out of order are the leather packings; those marked *l, m, n, p, q*, would cause the jack to leak externally, and any disorder in them can be easily detected, and the packings replaced with new; those marked *i, k, o*, would injure the lifting power, and would necessitate the taking to pieces of the jack, and its careful examination.

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* NOTE.—These Jacks are mostly used on the "left" side of carriages. Those required for use on the "right" side as in "right" carriages of Turrets have the upper part of the plunger drilled and a spindle, *z*, inserted (as shown in Fig. 9.), which opens the release valve *g*, when the plunger is pressed upwards by pushing the lever K towards the rear.

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To get to the inlet valve *e*, remove the cap C, and the plug N, when the valve can be examined.

To get to the outlet valve *f*, remove the cap D and the plug O.

To get to the plunger P, remove the cap A, the screw W, and the gland I, when the spindle X, and crank G, are free to be removed; unscrew the cap E, and the plunger and cap are free to be lifted out.

To remove the leather packing *p*, detach the ram R from its connexion to the crank on the rear eccentric shaft, and withdraw the ram.

To remove the jack from the carriage, detach the ram R from the crank on the eccentric shaft; the trunnion of the ram will then slide out of the bearing on the carriage.

A proportion of spare leather packings should be supplied.

A spare jack is issued with each carriage.

A gauze covering F is secured over the inlet valve *e*, to prevent the ingress of dirt.

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CHAPTER V.

INSTRUCTIONS for Examining, Re-venting, and Minor Repairs to Rifled Guns in charge of the Royal Navy.

REGULATIONS FOR THE INSPECTION AND REPAIR ON SERVICE OF RIFLED ORDNANCE.

General Instructions.

Final condemnation.

1. It requires great practice and experience in order to become a competent judge of the various conditions of all the different natures of ordnance in the service, *final* condemnation will be pronounced only by the authorities of the Royal Gun Factory.

Provisional condemnation.

2. In all cases, however, where there are sufficiently serious defects, or if there be any doubt as to the serviceable state of the piece, it must be *provisionally* condemned, pending the decision of the Superintendent, Royal Gun Factory.

Period of service at which examination is to take place.

3. All ordnance will, as far as possible, be examined regularly after the following numbers of rounds, and practice from such ordnance should cease until such examination takes place.

Natures.				No. of Rounds with Projectiles.
Rifled	ML.	16-in., 12·5-in., and 12-in. of 35 tons		32
		12-in. (of 25 tons), 11-in., 10-in., and 9-in.		50
		8-in., 7-in. and 64-pr.		100
		below 64-pr.		150
	BL.	screw	7-in.	100
			40 pr. and under	150
		Int. screw	6-in.	100
			4 in. 22 cwt.	100
			4 in. 13-cwt.	150

For purposes of computation four rounds of blank charges may be considered equal to one with projectile.

Special cases.

4. In all cases, however, should there be any appearance of fissures about the vent (*see* para. 54, p. 13), or defects likely to develop, guns will be examined more frequently, at the discretion of the Inspector or Examining Officer, but in the case of guns on board a sea-going ship they should, if possible, be revented, and otherwise made serviceable, rather than be sentenced for a limited series of rounds, a course which should be avoided where practicable.

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Examination of guns on ships at home.

5. Officers commanding Her Majesty's ships at home will, as the exigencies of the service permit, when a piece requires to be examined in consequence of its having fired the prescribed number of rounds since previous examination, or for any other cause, forward a return on Army Form G 872 for M.L. or 925 for B.L. guns to the Senior Ordnance Store Officer at the station or district, with a request to have the piece examined. After the examination the sentence will be entered on the above form, which will be delivered to the officer commanding the ship,* to be sent through the proper channel to the Secretary of the Admiralty, for transmission to the War Office.

Examination of guns on ships abroad.

6. Officers commanding Her Majesty's ships abroad will, as the exigencies of the service permit, when a piece requires to be examined in consequence of its having fired the prescribed number of rounds since the previous examination, or from any other cause, forward, with a request that the piece may be examined, a return on Army Form G 872 for M.L. or 925 for B.L. guns to the Senior Ordnance Store Officer at one of the stations where there are Inspectors of Warlike Stores, viz.:—

Barbados.	Ceylon.	Hong Kong.
Bermuda.	Gibraltar.	Malta.
Cape Town.	Halifax.	Mauritius.

The Ordnance Store Officer, on receipt of such requisition, will make a demand upon the officer commanding Royal Artillery for the examinations to be made by the Inspector of Warlike Stores. On the completion of the examination, the sentence will be entered by the Inspector of Warlike Stores on Army Form G 872 for M.L. or 925 for B.L. guns, which will be sent to the Ordnance Store Officer for transmission to the officer commanding the vessel.* This latter officer will take such steps as he may deem necessary under the orders of the Senior Naval Officer.

Foreign stations at which guns can be revented.

7. The only foreign stations at which rifled ordnance can be re-vented are Bermuda, Ceylon, Esquimalt, Gibraltar, Halifax, Hong Kong, Malta, and Simon's Town.

Esquimalt and Simon's Town

8. As there is no Ordnance Store Officer at Esquimalt, or Simon's Town, application will be made to the head of the naval establishment for the service of the Naval Engineer Officer stationed at these places.

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* The Officer Commanding should, before forwarding this return to the Admiralty, extract all the information required by him to complete his next annual return.

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When an I.W.S. is not available.

9. Should the services of an Inspector of Warlike Stores not be available, through the ship being at sea, or from any other cause, when the guns require to be examined, the examination will be carried out, if possible, by a naval officer, possessing a certificate of competency to provisionally examine naval ordnance and make the necessary recommendations for minor repairs or provisional condemnation. After provisional condemnation such pieces will not again be used until an examination has been made by a qualified examiner at home, or an Inspector of Warlike Stores abroad, and sentence passed in due course.

Sea-going vessels.

10. No ordnance on board a sea-going vessel should be sentenced otherwise than *serviceable* or *unserviceable*, except in regard to minor repairs, which can be carried out at once on the spot. In a doubtful case the ordnance should be provisionally condemned.

Royal Marine Artillery, Royal Naval Artillery Volunteers, Royal Marines, &c.

11. Officers Commanding Royal Marine Artillery, Royal Marines, and Royal Naval Artillery Volunteers, and Her Majesty's Coast Guard and Royal Naval Reserve Batteries on shore will, when a gun requires to be examined in consequence of its having fired the prescribed number of rounds since previous examination, or from any other cause, forward, through the proper channel, for transmission to the War Office, a return on Army Form G 875, together with gutta-percha impressions of vents and important defects observed in bore and powder chamber.

After examination of the impressions, and also when ordnance are inspected by Examiners from the Royal Gun Factory or Ordnance Store Departments, Devonport and Portsmouth, the result will be notified to the Officer in charge.

If no person competent to take impressions, as laid down in 20 and following sections, be available, application should be made to the Senior Ordnance Store Officer of the district to have this service performed.

Impressions of guns re-vented.

12. In every case where a gun is re-vented impressions of the vent, both before and after re-venting, should be forwarded through the proper channel for the information of the Superintendent, Royal Gun Factory.

Inquiry to be made immediately into the cause of accidents.

13. When any accident occurs, either at home or abroad, such as the bursting of a shell in the bore, the splitting of an obturating cup, vent-piece, &c., immediate inquiry will be made into the circumstances, and the ordnance examined. If the Commanding Officer considers the damage to be of

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importance, he will send without delay a report of the circumstances through the same channel as his Annual Return, forwarding, if necessary, for the illustration of his report, gutta-percha impressions of the damage done to the ordnance.

Memorandum of examination.

14. Every rifled gun issued from the Royal Gun Factory is accompanied by a "Memorandum of Examination," which contains a record of the material of the bore, and of the number of rounds fired, as well as the particulars of any slight defects which may exist in the piece at the date of issue. This Memorandum will remain in charge of the Officer who has possession of the ordnance, and a certificate to the effect that it is in possession, and complete up to date, will be included in the Annual Return of Rifled Ordnance, Army Form G 872 or 925, as the case may be. At the conclusion of each day's practice with the piece, an entry will be made in the Memorandum by the Officer in charge, giving a detail of the rounds fired (including blank charges), so that an accurate record of the firing may always be kept up. The results of the examination of any piece will be added to the Memorandum by the Officer or other examiner who performs the duty, and when the gun is returned into or issued from store the Memorandum will accompany the transfer vouchers. If at any time the Memorandum be lost or damaged, a duplicate can be obtained through the Admiralty from the Superintendent, Royal Gun Factory. Inside sheets for continuation of the record of the number of rounds fired can be obtained on demand from the Ordnance Store Department.

Instructions for the Guidance of Examiners in the Inspection of Ordnance.

Preparing ordnance for examination.

15. When ordnance is to be examined, the bore will be thoroughly cleaned and dried; it is not possible to detect small defects, which may sometimes be of importance, if the bore be in a rusty or very greasy state. If care has been previously taken in keeping a gun tolerably clean, it will probably be sufficiently prepared for examination by washing, brushing, and drying with tow or a clean sponge-head. If, however, there be hard rust which will not yield, or a thick coating of lacquer or grease, the bore may be cleaned either by firing, if circumstances admit, one or two scaling charges, about one-third the full service charge, without projectiles, which will usually loosen the scale, or

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by the use of hot water and potash, in the following manner:—

Method of cleaning with potash water.

16. About a gallon of boiling water is poured on one pound of black American potash, and an old sponge, covered with a canvas cap, or some substitute to make it tight to the bore, is dipped into the solution. The bore is then rubbed till the dirt is loose, when the hard brush will remove it, and the bore is then wiped dry with tow, &c., and slightly oiled. The potash water must be used very hot, and the sponge must be very tight, or the process is ineffectual. If the dirt be very thick in the small grooves of the B.L. screw guns, a common pricker with blunted point is useful. No sharp-edged or pointed scrapers will be employed for cleaning the bores of rifled ordnance; they are unnecessary, and are liable to injure the rifling.

Examination of Bore.

Tools.

17. For the purposes of this examination the tools provided (*vide* Table, p. 35) are to be used.

Defects in bore.

18. Should any defects be discovered, they need not be taken notice of unless they are new defects not shown in the "Memorandum of Examination," or old ones which have materially increased. If, however, defects be of the nature mentioned, impressions will be taken of the bore, as under:—

Impressions required.

R.M.L. converted guns.

a. R.M.L. Converted Guns.—Impressions of the whole of the powder chamber, showing also the cup and the joint where the cup closes the end of the bore.

R.M.L. wrought-iron ordnance.

b. R.M.L. Wrought-iron Ordnance.—Impressions of the powder chamber, showing bottom of the vent, and the bore for a distance of three feet from the commencement of the rifling, to allow of the piece being pronounced serviceable or otherwise for use with gas-checks. If the examination is merely to ascertain the amount of the erosion, an "up" impression will be sufficient.

R.B.L. guns, screw.

c. R.B.L. (*Screw*) *Guns.*—Impressions will only be taken where flaws are seen, and, as a rule, of the breech bush in the gun, and of the face of the vent-piece.

Int. screw.

d. R.B.L. (*Interrupted Screw*) *Guns.*—Impressions of the powder chamber, showing copper obturating ring, front slope, the commencement of the rifling, and impressions also of any flaws which may be seen in the bore.

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19. The depth of the erosion can be measured with sufficient approximation from the gutta-percha impressions by laying a straight-edge held parallel with the bore on the top of the impression of such erosion, and then by measuring with compasses the height above an unworn portion of land or groove. Measuring erosion.

Taking Impressions of Bore.

20. For taking impressions of the powder chambers or of short portions of the bores of rifled guns, special instruments are issued. Powder chambers and bores of rifled guns.

21. The common kind of gutta-percha, used for soles of boots, is suitable for the purpose of taking impressions. It can be used over and over again, and need never be thrown away if a little fresh material be added from time to time to prevent it from becoming brittle. It should not be allowed to become mixed with dirt or grit, and it should be kept in water when not in use. Gutta-percha.

22. To prepare it, a sufficient quantity is softened by being put into boiling water, and is then worked and kneaded on a smooth board until the air and water are expelled, and a smooth surface obtained. Preparation of gutta-percha.

23. Before impressions are taken, the bore should be quite clean, but slightly greasy; if quite dry, the gutta-percha will adhere to it, and the impression be damaged in removal. Bore should be greasy.

24. To use the "instrument for taking impressions of "bores," gutta-percha prepared as above is laid on a gun-metal plate secured by screws to a frame. The upper part of the frame itself answers as a plate for some natures. The frame is attached to a long hollow tube, and is so made that the upper portion can be raised or lowered by bell-crank levers worked by a right and left-hand screw. This screw forms part of a rod passing through the frame handle, and to the outer end of the bar is attached a cross handle, by working which the plate carrying the gutta-percha can be forced up against the surface of the bore or powder chamber when required, and lowered when the gutta-percha is sufficiently hardened. Bore.

25. Wax composition, which may be used instead of gutta-percha for taking temporary impressions for examination on the spot, is made of beeswax two parts, treacle one part, Wax composition.

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soft soap one part. The wax should be melted over a slow fire in an iron pot, the treacle being first added and mixed well by stirring, and lastly the soft soap, a little at a time. The wax must be kept in motion, and, when thoroughly mixed, poured out, and made into balls when cool. This composition, being soft, is always ready for use, but is easily destroyed by handling. The cushion or pad of gutta-percha will be removed from the pan of the instrument for taking impressions of vents before the wax composition is applied.

Position of defects, how noted in returns.

26. In order to note in returns the position of any defect upon an impression, their distance from the muzzle is measured in inches, and noted as *up, right of up, &c.*, as the case may be.

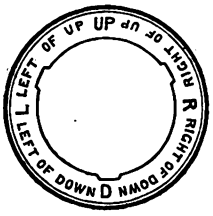
Powder chamber.

Defects in powder chambers of R.B.L. screw guns are measured from the breech end, and noted in a similar manner to defects in the bore.

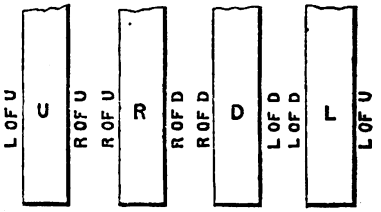
"The position of all defects in B.L. interrupted screw guns is measured in inches from the muzzle."

Circumferential defects.

Circumferential defects are noted round the bore in the direction of the movement of the hands of a clock—*e.g.*, R of U to R of D, L of D to L of U.



IMPRESSIONS ARRANGED FOR RECORDING DEFECTS.



MUZZLE DIRECTION.

Label to be gummed to impression.

27. When an impression is forwarded with a return for report or decision, a label will be gummed to the back, showing the name of the ship, corps, battery, and station, the date of taking the impression, the direction of the muzzle, the nature and number of the piece, and the position of the fissure (if it be in any part but the vent), defined according to the directions. The impression should be reduced to the smallest dimensions compatible with showing the whole of the defect.

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Defects in Bore.

28. With rifled ordnance the following defects are likely to be found:— Rifled ordnance.

29. Tool marks, or slight irregularities and scratches caused in manufacture during the boring and rifling. A chip or grain of sand, getting between the boring or rifling head and the surface of bore, will cause such tool marks, while the emery powder used in lapping leaves very fine marks on the hard surface of the steel tubes. Tool marks.

30. With steel tubes,* on account of the hard smooth surface, these are more apparent and have been at times mistaken for fine cracks when running along the bore. To an experienced eye, however, the difference is easily perceptible. Steel tubes.

31. Slight wear of the sides of the grooves from the friction and over-riding of the studs of projectiles is also found at times, but this takes place as a rule only in guns having iron tubes, or when with steel tubes a uniform twist is employed with a heavy gun. Wearing of the grooves.

32. With wrought-iron "A" tubes* imperfections of weld often exist, and scarcely any are quite free from them; they are, however, of little consequence as a rule, unless they are found to increase very much when the gun is used. Defects in wrought-iron barrels.

33. The following are the technical names of the several defects likely to be found in wrought-iron barrels:— Technical names of defects.

a. Coil marks, where the line of coil running round the barrel is visible, the weld not being quite perfect; but in this case the defect has no appreciable depth, and is of little consequence. Coil marks.

b. Defective welds, the same sort of defect as coil marks, but deeper and more important; they run round the bore in coiled barrels, and along it in solid forged barrels. Defective welds.

c. Specks, small spots, and pin holes in the metal, caused by dirt in iron, blisters, &c. These sometimes occur in clusters. Specks.

d. Flaws, larger defects of the same nature. Flaws.

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* The material of which the barrels are made has for some years past been stamped on the muzzle, and is also entered on the Memorandum of Examination.

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Longitudinal cracks.

e. Longitudinal cracks are also found in solid forged barrels, caused by the gas eating into the defective welds and splitting the barrel lengthways.

Certain defects of little importance in coiled barrels.

34. The experience of years has proved that flaws, coil marks, and even defective welds are of little importance in guns not exceeding the size and power of the 7-inch B.L. gun. The importance of a defect depends in a great measure on its position in the gun, one in the rear of the trunnions, especially if in the powder chamber, being more dangerous than one of the same nature and extent in front of the trunnions, as the powder gas acts much more rapidly upon it, and it is liable moreover in M.L. guns to hold a piece of ignited cartridge. Few instances have occurred in which defects in coiled barrels have caused accidents or have increased in any material degree after issue, unless they exist in the powder chamber, and for this reason no guns have been issued for some years past with any defect except of the most trifling character in that part of the bore.

Longitudinal cracks in coiled barrels.

35. It has been found that in M.L. ordnance having coiled iron barrels (64-pr. and a few of the heavier natures) the tube occasionally splits in the chamber in continuation of the edge of one of the grooves. This, together with the difficulty of getting the material sound, has led to the abandonment of coiled iron for the barrels of all except converted guns, in which there is a peculiar gas escape to indicate when the breech portion of the inner tube is split.

But should a gun of this nature on examination be found to have flaws in the cup, or coil marks near the vent or in the powder chamber, except these defects are of the most trifling character, the gun should be provisionally condemned, and the same rule should be observed with regard to fissures in the grooves. Impressions of the vent should include a portion of the cup, and the bore to the extent of at least one inch all round the copper bush.

Defects in steel barrels.

36. Steel barrels are free from the defects so inherent to wrought-iron, and generally show a perfectly smooth and even surface, very slightly scored by a number of very minute tool marks. Occasionally a small piece is found chipped out as it were, but leaving a smooth hollow behind it, which, if small, is quite an unimportant defect.

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37. Longitudinal cracks at times occur which develop into splits. When such are found they are of far more importance than similar cracks in a wrought-iron tube. Longitudinal cracks in steel barrels.

38. A few instances have occurred in which steel tubes have split on service from the bursting of a shell inside the bore; in some of these the tube split at the muzzle. In cases where steel barrels have split in M.L. experimental guns when being tested for endurance, the crack has commenced at the edge of one of the grooves (as in coiled barrels) and extended into the powder chamber. As a crack in the chamber, should it exist, might be so fine as not to be visible from the muzzle, it is essential that impressions in gutta percha should in all cases be taken of the chambers of rifled M.L. ordnance, as before stated, and care must be taken to discriminate between a crack and a superficial streak or tool mark. Splitting of steel barrels, how caused.

39. Scoring or guttering is caused by the rush of gas round the projectile in R.M.L. ordnance, principally due to windage, and is common to both iron and steel barrels. This wear is principally over the top of the projectile, where the windage is greatest, owing to the projectile resting on its lower studs. In small ordnance this is very slight, but when very heavy charges are used the surface of the bore is gradually eaten away to a considerable extent. Even in extreme cases, however, scoring has not caused the destruction of a piece, though in some instances, acting on the corner of a groove, it has tended to split the tube. The erosion generally begins in front of the chamber of the piece, near the commencement of the rifling, and is usually found to extend, according to circumstances. 4 or 5 feet up the bore. Slight traces of erosion are also found in the powder chamber itself. Scoring or guttering, R.M.L. guns. Defects common to both iron and steel barrels.

40. Dents or abrasions are caused by the bursting of a shell in the bore; these are as a rule of very little importance. In one or two instances muzzles have been blown off from this cause; but generally the only result is to cut up and graze the bore more or less. It is found that such injuries seldom interfere with the efficiency of the piece, and an armourer can generally file down any metal set up in the bore. Dents or abrasions due to shells bursting.

Sentence as to Bore.

41. In sentencing ordnance, according to the state of the bore, it is essential to discriminate between defects which are characteristic of the material, and cannot wholly be avoided in manufacture, and those which are created or Sentence as to bore.

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developed on service, such as cracks in a steel tube. In coiled barrels defects are often numerous, and generally of little importance, while in steel barrels the case is reversed; defects seldom occur, but when they do, they are, generally speaking, of great importance.

Extent of defect.

42. It is almost impossible to lay down any definite rules as regards the extent or depth of a defect which should necessitate the condemnation of a barrel; a great deal must be left to the judgment and experience of the inspector.

Sentence on coiled barrels.

43. Unless there is reason to believe that there has been some material change from the former state of the defects, ordnance with coiled barrels need not be condemned. Speaking generally, the depth of a defect is of more importance than its extent, but should a defective weld run right round the bore, the piece would be liable to part at that point, and must be considered unserviceable.

Solid forged.

44. In solid forged barrels a flaw running lengthways has a tendency to develop into a crack, especially if it occurs in the powder chamber. If the inspector finds a case of this kind he will put the gun aside, but he will endeavour to discriminate between this and a mere streaky line, which is unimportant.

Int. screw R.B.L. guns.

Should the fissuring or scoring over the shoulder of powder chamber in R.B.L. Int. screw guns be very apparent, then further impressions along the bore must be taken. Should the fissures be ·05″ deep and 1″ long the gun is to provisionally condemned.

Steel barrel.

45. In steel barrels any crack, however fine, would necessitate the provisional comdemnation of the ordnance.

Testing barrels.

46. The best method of testing ordnance is to take an impression of the defect, then to fire a few rounds and take another impression; if, on comparing these impressions, the defect does not appear to have increased, the barrel may be considered as serviceable.

Firing with gas-checks.

47. When sentencing pieces from which projectiles fitted with gas-checks are fired, it will be necessary to state in the remarks column of the Memorandum of Examination, as well as on Army Form G 875, with regard to the extent of scoring or guttering, whether the bore is in a sufficiently good condition for firing with gas-checks.* Gas-checks should not be used with pieces the erosion in which exceeds 0·125 inch in depth at any part, as pieces of the gas-check

* The use of gas-checks, when employed from the commencement of firing a new piece, much diminishes erosion.

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are liable to be torn off, when expanded, into such recesses, and the shooting of the piece is thereby affected.

Examination of Vent.

48. Besides examining the bore of a piece of ordnance, it is necessary especially to examine the vent-bush itself, and that part of the chamber or bore of the piece where it enters. Examination of copper vent-bush.

Where a copper vent-bush is employed, the vent channel is thoroughly cleared and scraped, and then gauged by means of a set of gauges issued for the purpose. Gauging.

49. It is not uncommon to find a choke where the metal has been set up near the bottom of the vent; this should be removed by a drill or rimer before the gauge is taken. Choke.

50. A clean impression of the bottom of the vent must also be taken, this will be taken with the instrument for taking impressions of bores, the plates for which are fitted with ends to suit the chambers of guns, or they may be taken with the instrument provided among the tools for venting ordnance. Impression of vents.

51. R.B.L. guns are vented* through the breech-block or vent-piece (*see* para. 67, page 82). R.B.L. guns.

52. After re-venting, ordnance will be considered as serviceable for a fresh number of rounds. Ordnance serviceable after re-venting.

Defects of Copper Vent-bushes and Sentence.

53. The effect of firing on a vent is seen either by a gradual increase to the channel of the vent itself, by an irregular wearing away of the bottom by the metal of the vent setting up, and the gas forming a hollow ring round it, or by fissures or hair lines radiating into the metal of the bore from the edge of the vent-bush. Effects of firing on vents.

54. Ordnance will be sentenced either for re-venting or condemnation, according to the state of their vents, as follows:— Sentence.

(*a.*) Converted rifled guns to be re-vented if 0·3 inch gauge passes down. Converted guns.

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* Except 4-in. 13 cwt. which are radially copper-vented, and should be treated as R.M.L. guns, the tools for which are applicable; and 4-in. 22 cwt. that have movable steel radial vents.

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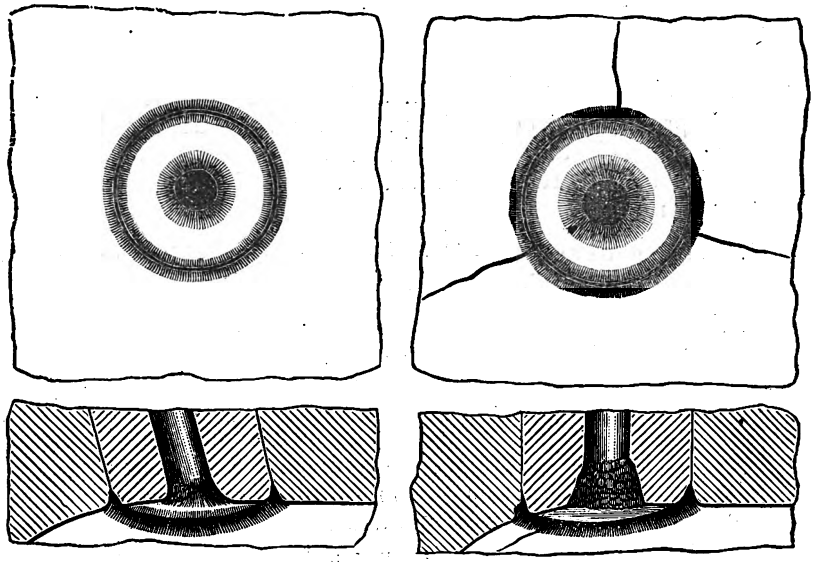
Other rifled ordnance.

(*b.*) Other rifled ordnance, if 0·275 inch gauge passes down.

(*c.*) The metal round a bush begins to give way almost immediately after a piece is vented, forming a hollow ring round it, which gradually increases. So long as this wear is uniform, and the edges are not jagged, it is not of importance.

(*d.*) If, however, the edges are ragged, or if one side has given way much more than the other, so as to be likely to hold a piece of unconsumed cartridge, the examiner must use his discretion as to sentencing the ordnance, it being impossible to lay down fixed rules for all cases.

Fig. 1. Fig. (2).



(*e.*) Fissures or hair lines, radiating from the edge of the bush, will be found. These will often be on either side, and a third to the front.

(*f.*) Should the above-mentioned ring (fig. 1) be worn away round bottom of bush, be 0·075 inch wide or 0·1 inch deep, or jagged and irregular, so as to be, in the opinion of the examiner, likely to retain a piece of cartridge, the gun will be condemned for re-bushing, and, if possible, with a cone bush. Much wear of the lower portion of the fire-channel in the vent will also necessitate the re-venting of the gun. The amount and nature

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of wear which should condemn a vent must be left to the judgment of the examiner. Generally speaking, if any sign of fissure of the copper is apparent, or if the thickness of the wall is much reduced in any part, the vent must be condemned. In case of hair lines radiating from the edge of the vent in steel-lined pieces, the gun must be provisionally condemned should the hair lines be 1 inch in length, unless when directly to the front or rear, when the limit of condemnation is smaller, ½ inch, owing to that position being the worst for the development of a crack. The measurements are taken from the edge of the bush.

Fissures in steel barrels.

55. In heavy ordnance, with steel barrels, a so-called fissure frequently developes in front of the vent (caused apparently by the rush of gas through the vent channel). This fissure partakes at first of the nature of a slight scoring; if not attended to, it may increase in depth to a crack. Such a fissure should, therefore, be filed out, and an examiner must use his judgment as to when this operation is necessary, but in no case should such scoring be allowed to attain a depth of 0·01 inch.

Discretion as to sentence.

56. Although a properly instructed examiner will generally be able, with the aid of the above rules, to sentence a vent either as serviceable for a further series of rounds or for re-venting; yet, except for sea-going ships, many cases will arise in which it will be advisable for the vent to be sentenced as fit to fire some smaller number of rounds, and then to be further examined. Such cases must be left to the discretion of those whose duty it is to give sentence on the impressions taken.

In sentencing a gun to be re-vented, it is to be stated whether a cone vent ($\overset{C}{V}$) or a through vent ($\overset{T}{V}$) is required. according to state of the bottom of vent as shown by the impression taken, as follows:—

(*a.*) If a circle drawn round the centre of vent, with a radius of ·35 inch, includes all the damaged part, a cone vent.

(*b.*) Radius above ·35, but *less* than ·5 cone vent, but part of cone cut away.

(*c.*) Radius ·5 inch through vent.

Removable, axial, and radial vents.

57. With such guns as are provided with removable vents, these should, after gauging, be taken out and in-

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spected for cracks, and for the accuracy of the screw threads on the exterior. The amount of scoring also at the mouth should be reported upon, the vent not being condemned until such enlargement approaches closely the outer edge of the steel bush.

To remove axial vents of 12·5 inch (Mark II.) and 16 inch R.M.L. guns, take off socket supporting vent, remove the vent-nut with the wrench supplied for the purpose; the double key can then be taken out, and the vent pushed forward on the cradle, which is withdrawn. Before re-venting, insert the shank of acorn guide in the vent, which can then be replaced and secured with the double key and nut.

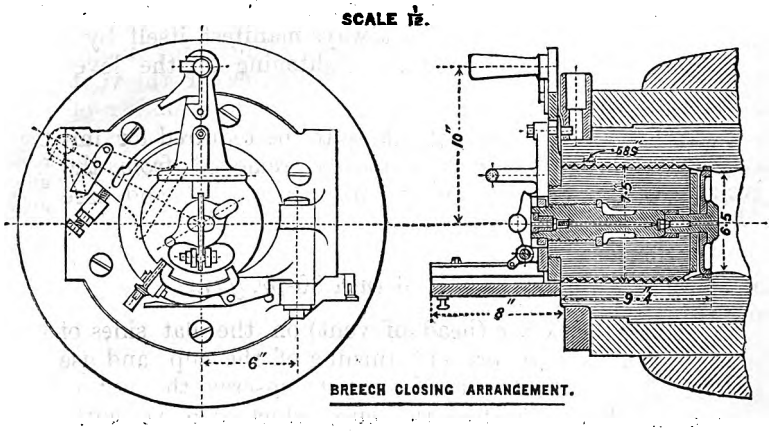
In 16-inch R.M.L. guns the socket supporting vent is attached to the breech of the gun, but in the 12·5-inch it is attached to the interior of the shutter.

In 4-inch B.L. guns, 22 cwt., the radial vent is removed by taking off the vent-nut with the wrench, and pushing the vent into the bore. In replacing it, the vent is turned till the slot is opposite the feather in the gun, inserted and secured as before.

B.L. gun fittings.

Examination of B.L. Fittings.

6-inch 80-pr. Guns.



BREECH CLOSING ARRANGEMENT.

Bolt, vent.

58. Examine thread of vent-bolt, ascertain if the nut works correctly and the spring be sound.

Bracket, retaining.

59. The bracket should be free from burrs, and allow of the ready entrance of the lever-catch of the carrier.

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60. Carrier complete, with hinge-pin, washer, and keep-pin. Especial attention should be paid to the lever-catches of the carrier, and the soundness and good working of their springs. Carrier.

61. The obturating cups should be turned round when on the breech screw, and their outer edge carefully inspected for marks and lines indicative of gas in motion. Any such defect on the exterior of the lip would condemn the cup; cracks in the steel should also be looked for. Cups, obturating.

Care should be taken that the edge of the cup is kept uninjured and free from burrs. Should any burrs or notches be observed, the cup should be removed and replaced by another one. Burrs on cups.

Abrasions on the edge of the cup can generally be removed with a dead smooth file. The proper action of the cup depends upon the slightly convex form of the base upon which it rests. Each time the gun is fired the flat underside of the cup is forced by the pressure of the gas to take the form of the base, and the circumference is thereby expanded so as to tighten against the ring of copper which surrounds it. If the underside of the cup should by continued firing partially lose its flatness, and take a permanent hollow form, it may be packed up by inserting beneath it one of the thin brass discs provided for the purpose. These discs are of two thicknesses to meet different degrees of hollowness. The hollowing of the underside of the cup will always manifest itself by a diminution of resistance to the tightening of the lever against the stop. Abrasions on cup. Brass discs.

62. When the gun is not likely to be required for immediate use, the steel cup should be removed from the breech screw, and kept in a dry place, oiled and free from rust. Cup to be removed when gun is not in use.

To remove a cup—6-inch 80-pr. gun.

63. Hold the key *c* (head of vent) on the flat sides of head of vent-bolt to prevent turning of the cup, and use the key *b* (forked for nut of vent) to unscrew the nut of vent-bolt. This will free the cup, which can be withdrawn to the front. The vent-bolt should be then unscrewed from the cup and the washer and nut taken out to the rear. Removing a cup, 6 inch, 80-pr.

To replace a cup screw the vent-bolt, with three brass discs beneath it, on to the cup, put the cup in position, and Replacing a cup.

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then from the rear arrange the washer, so that the key-guide on it fits into the slot in the vent-bolt; now put on the nut, screwing it up with key *b*, and holding the vent-bolt head with the hand. When the nut is nearly home, force the breech screw into position in the gun, so as to centre the cup, then withdraw the screw, and, holding the vent-bolt head with key *c*, screw up with key *b*.

No. of cups be quoted.

64. In all reports the number of the cup is to be shown.

Holders.

65. Both electrical and mechanical holders should be sound, the mouth uneaten by gas; the needle should be taken out of the latter, and that and the small spring inspected for soundness.

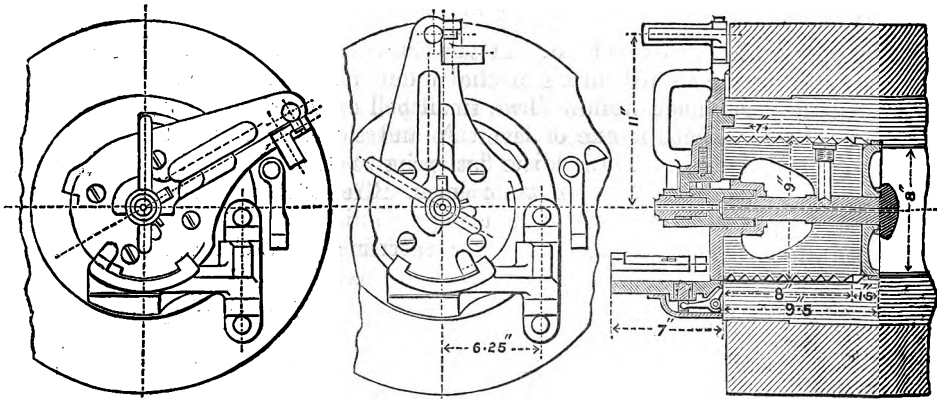
Lever and firing hammer.

66. The lever with its handle should be sound; the firing hammer inspected as to the nose, and that no crack exists at the junction of the weighted head.

6-inch 81-cwt. gun, Mark II.

SCALE $\frac{1}{12}$.

BREECH-CLOSING ARRANGEMENT.



Removing cup and vent.

67. To remove the cup and vent, unscrew the set screw in the upper relieved portion of the breech-screw, which enables the cup and vent to be withdrawn to the front. Reverse the operation in replacing the cup. In all reports the number of the cup is to be shown.

6-inch 80-pr., 6-inch 81-cwt., Mark II., 4-inch 22-cwt., and 4-inch 13-cwt.

Breech screw.

68. A gauge is issued for inspection of this fitting. The inner edge of it is laid on the smooth portion of the screw and over the curved front; thus any bulge or setting up

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of the screw would be apparent. The threads of the screw are gauged by the upper edge. Should the screw threads be found set up, the breech-screw would not be condemned unless it was found not to work readily in the gun. On the other hand, if a breech-screw were found to jamb in working, this gauge would enable the examiner to detect the defect, which might often be remedied by filing. On no account should any portion of the thread be cut away to remove a crack, &c.

69. The clip retaining is fixed to the lever handle by a screw. If the spring be weak, the clip may be taken off and a new spring inserted. Clip retaining lever.

70. Place a light in rear end of chamber, and pass round the top of the finger over its surface for gas marks. The marks will show also on the gutta-percha impressions referred to in pp. 7 and 8. Rings, copper, obturating.

71. The regulations for the inspection of the cups, rings, copper obturating, and breech-screw, are the same for all the above natures, *vide* para. 61, &c. Rings copper obturating cups, breech-screw.

72. If the carrier be found not to work correctly, it should be removed from the gun, and the under plate unscrewed, revealing the mechanism. Two small bell crank levers will be found within, stamped lever A and lever B. Their spindles may be unscrewed, the flat spring below lever A or the spiral spring round stop of lever B replaced, or such other parts as may be found damaged. Carrier.

The catch and clip-retaining for carrier, and catch clip-retaining and hinge plate, all of which are fixtures on breech, should be inspected for soundness and for proper working when the carrier is attached. Catch, clip-retaining, for carrier.

4-inch 22 cwt. and 13 cwt.

73. Two wrenches, A and B, are supplied for each of these guns to remove the nuts of the spindle. Take off the nuts of the spindle, the spindle and cup can then be taken out. To remove cups.

Screw Guns.

74. The breech-screw will be examined with the straight edge, in order to ascertain that the face is quite flat and true; if it be not, it will be filed; the thread should be examined by tapping with a wood mallet, and should not be broken or Examination of breech-screw.

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burred, but a considerable portion may be removed, if injured, without destroying the efficiency of the screw.

Lever, tappet, and keep-pins.

75. The lever and tappet should be sound. The lever handles of naval guns are sometimes broken off, but the lever can still be used in this state, though not so conveniently. The keep-pins must be sound.

Vent-piece.

76. The vent-piece is the most important fitting, and should be perfectly sound, neither cracked nor bulged. The back and sides, when tested by the straight edge, should be quite flat and true. The fracture of vent-pieces is frequently owing to the back not being true to the face of the screw. The copper ring on the vent-piece, as well as the breech-bush at the end of the barrel, must be sufficiently high to prevent the action of the gas on any part of the iron. The angle face of the 7-inch vent-piece should be flat, and should work truly against the end of the barrel, and the nose should fit closely, but not too tightly, into its place. The copper bushes in the neck of the vent-piece should be in good order. If they are so much worn that a 0·3-inch gauge can pass through, the friction tube is liable to be pulled out without being fired; the bushes will then be renewed from the spare sets issued for that purpose. A cavity frequently forms at an angle of the vent channel, but this (which should be examined with a probe) does not entail the immediate condemnation of the vent-piece, unless the examiner considers it dangerously large.

Cross-head.

The cross-head should not be loose, as instances have occurred of its being broken off whilst firing. In all cases before taking a vent-piece into use for practice it will be advisable to test the soundness of the cross-head, as well as that of the neck, by tapping with a hammer.

Obturation.

77. The bush will be sentenced to be renewed if found to be so much expanded that the gas could escape between it and the tin cup or vent-piece, and when it is not possible to remedy the same by facing. In order to prevent serious damage to gun and vent-piece, especial attention should be paid, both before and during practice, to the breech-bush in the gun and the copper ring on the face of the vent-piece. If at all dented they should be carefully faced before use. During practice the officer in charge should take means to ensure these points being looked to constantly, and should stop practice with any gun or vent-piece in which eating away of the copper by the escape of gas begins to show itself. When this once sets up, a few rounds are often sufficient to damage permanently the gun or vent-piece.

Breech bush and copper ring.

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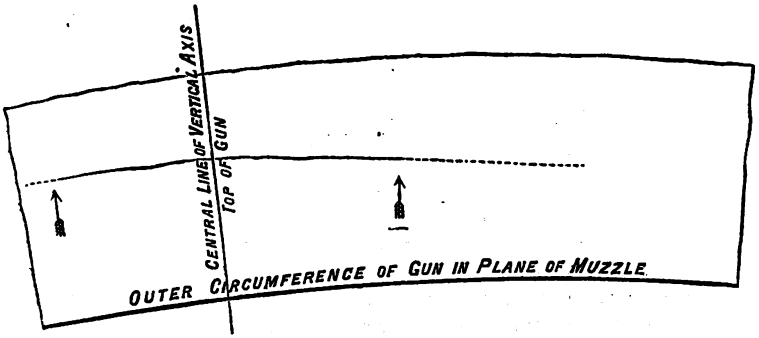
Examination of Exterior of Ordnance.

78. Very considerable defects may exist on the exterior of wrought-iron ordnance, without the strength being affected. Occasionally, on firing, one of the outer tubes developes a flaw running round the gun, due to the coil or tube having been in an undue state of tension. Such defects are, as a rule, unimportant, and are easily repaired when the gun passes through the Royal Gun Factory. Wrought-iron ordnance.

79. Defective welds on the exterior, near the muzzle, are sometimes developed in the "B" tube. Defective welds.



80. The above sketch represents a defective weld in the exterior of the "B" tube of a 9-inch R.M.L. gun. The opening after seven rounds (two battering, five full) extended 30·5 inches round the chase at about 12 inches from the muzzle. The gun was then sent to the Royal Gun Factory for examination and repair. It was submitted to the test of firing 40 battering rounds, and the crack then extended 16·5 inches further, but no other alteration took place. Example.

81. This result shows that defective welds near the muzzle are of no practical moment, and that no ordnance should be condemned on such grounds alone, although it should be exchanged when opportunity offers. Result.

82. If it be found that a shell has burst in the bore, the exterior will be thoroughly scraped with old swords, and cleaned (with potash water, if necessary), in order to ascertain whether it is perfectly sound. Shell bursting in bore.

83. It also occasionally happens with wrought-iron ordnance that the outer coils shift on firing; if, on examination, the shifting is found considerable, the ordnance will be provisionally condemned, but a slight shift, which is some- Shifting of coils.

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times perceptible when the piece is first used, and which has gone no further afterwards, may be disregarded. Unless there be reason to suspect damage on the exterior, it will not be necessary to scrape the whole of the paint off the exterior whenever a gun is examined.

Large defects.

84. Large defects on the exterior will be noted on the "Memorandum of Examination."

REPAIRS—B.L. GUNS.

Instructions for Re-Coppering B.L. Guns.

Removal of the old Copper Ring.

85. A gun-metal guide block (A), similar to the breech screw, is placed in the gun. A hollow spindle (B) passes through the centre, carrying on its end a steel block (K) (cutting out old copper No. 1), of a little less diameter than the bore of the gun. A slot is cut in this block, in which is placed the cutter. The depth of cut is regulated by a feed spindle C, passing through the hollow spindle, having an undercut inclined plane on that portion in contact with the base of the tool, and a screw thread on its other end. Over the screwed part works a capstan head (D), by turning which the spindle can be either advanced or withdrawn, the cutter being compelled to follow the inclined plane by reason of its base being fixed by the undercut slot.

The feed motion for the boring blocks is given by the hexagonal nut (E).

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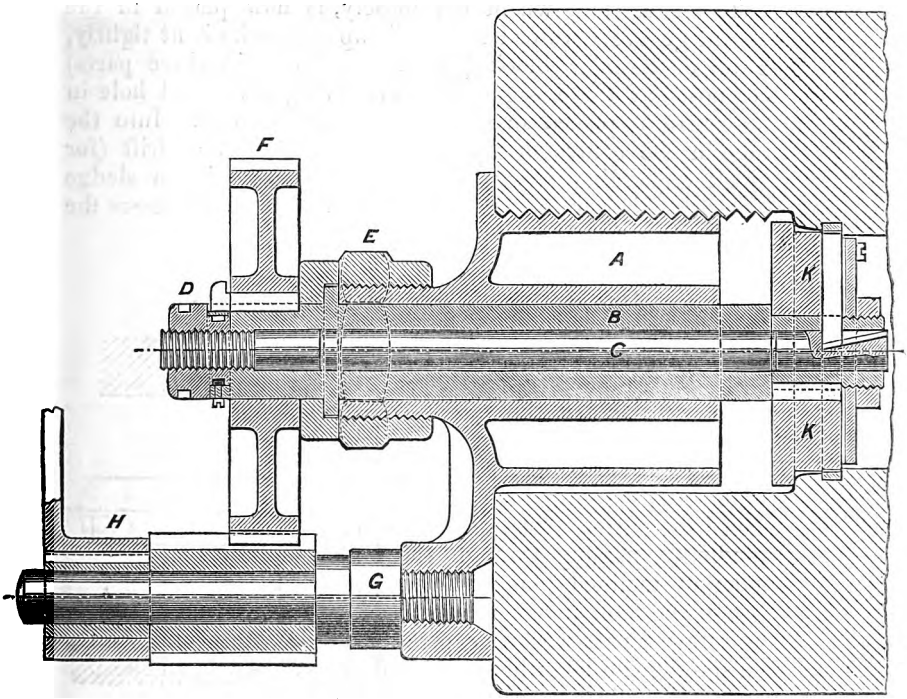
Fig. I. (cutting out old copper ring).



A toothed wheel (F) is fixed to the outer end of the hollow spindle. On the base of the guide block a bracket is cast, to which is screwed the pinion shaft (G). A pinion with handle (H) is placed on this shaft, and gears with the toothed wheel. The guide block having been placed in the gun, and the block with its cutter brought immediately under the copper ring, the latter is regulated for the cut by means of the capstan head. The pinion is shipped on the bracket and the toothed wheels brought into gear. On turning the handle, the block and tool revolve, and the copper in consequence is cut. The cutter first employed is only half the width of the copper ring; after half the ring is cut through the tool is changed for one the same width as the copper. A piece is cut out of the "block guide" to allow water, mixed with a little soft soap, to be injected with a syringe to make the copper cut freely and prevent tearing.

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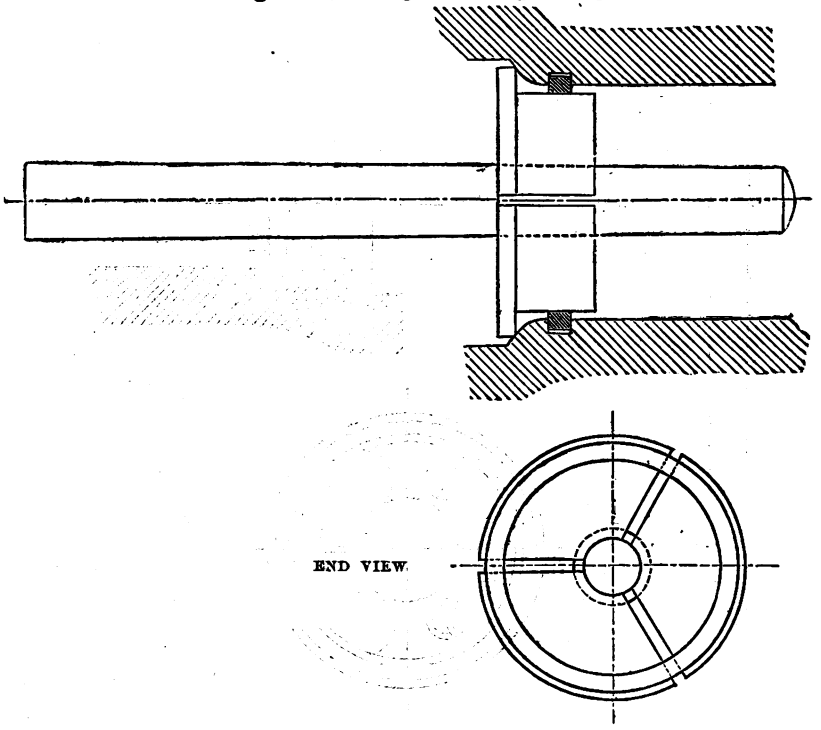
Placing the New Ring.

The new ring, which fits loosely, is now placed in the vacant groove. In order to set it up and make it fit tightly, a broad circular block (expanding No. 2 in three parts) composed of three segments, and having a tapered hole in its centre, is placed in contact with the copper. Into the hole in the centre of the segments is placed a drift (for block expanding No. 2) and smartly struck with a sledge hammer, this forces the segments outwards and presses the new copper ring into the groove.

Fig. II. (forcing new ring into groove).



The segmental disc is now removed, and a roller block (No. 3 for burnishing) of the following construction put in its place. This roller block has a tapered hole in its centre, and carries in recesses in the annular portion three steel wheels, having a large outward and inward play on their axles, these wheels project beyond the circumference of the disc, and also into the tapered hole through the centre. A tapered spindle (for block roller, No. 3) is driven hard into

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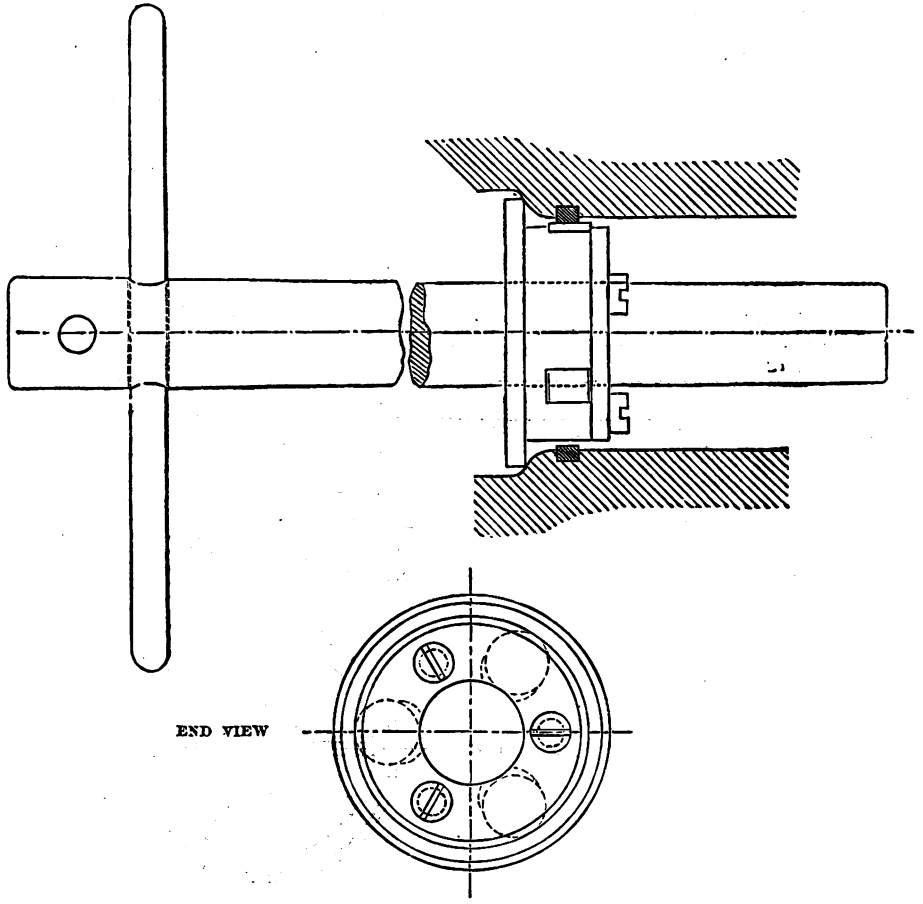
the central hole, and the steel wheels are consequently set out against the copper ring. A lever is now put through a hole in the outer end of the spindle and turned for about 10 minutes, this further forces the copper into the groove.

Fig. III. (expanding new ring).



The roller block is now removed, and the turning down of the ring commenced, the same appliances as were employed in the first operation are again used, but the block (rough boring, No. 4) on this occasion carries eight knives or cutters. When the ring has been turned down to within a few thousandths of an inch of its finished dimensions by means of the block (before proof boring, No. 5), the gun, with an obturator cup of slightly smaller dimensions than that of the

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service pattern, is then fixed to the breech-screw, and the gun fired a couple of rounds with blank charges, to further set up the copper; after which the ring is further turned down to its proper size with the same apparatus, the block (finish boring, No. 6) now carrying 14 knives set to their proper position for finished boring.

Copper ring (6-inch) after completion of repair, showing projection of copper over steel surface.

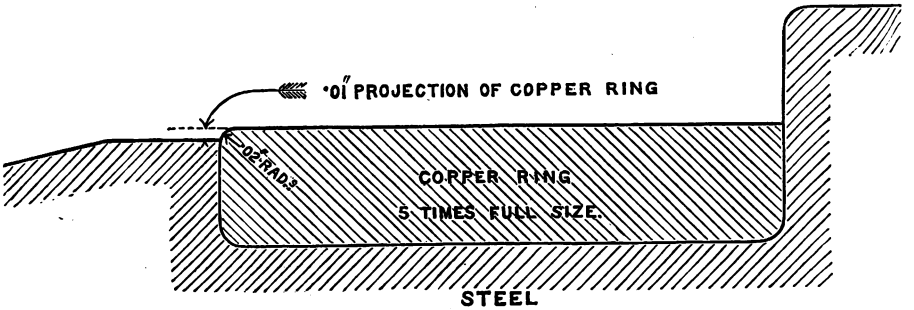
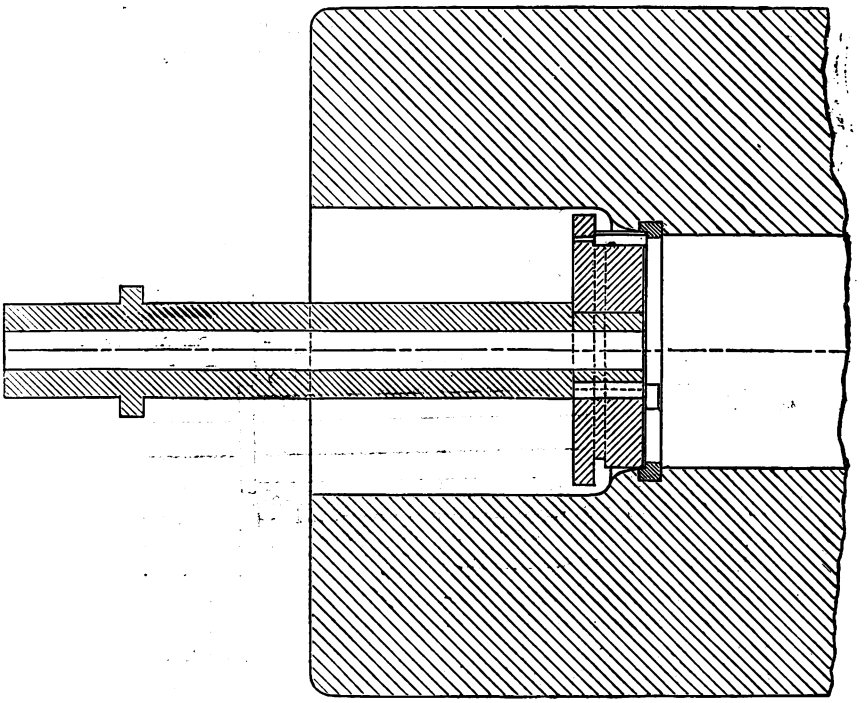


Fig. IV. (finish boring.)



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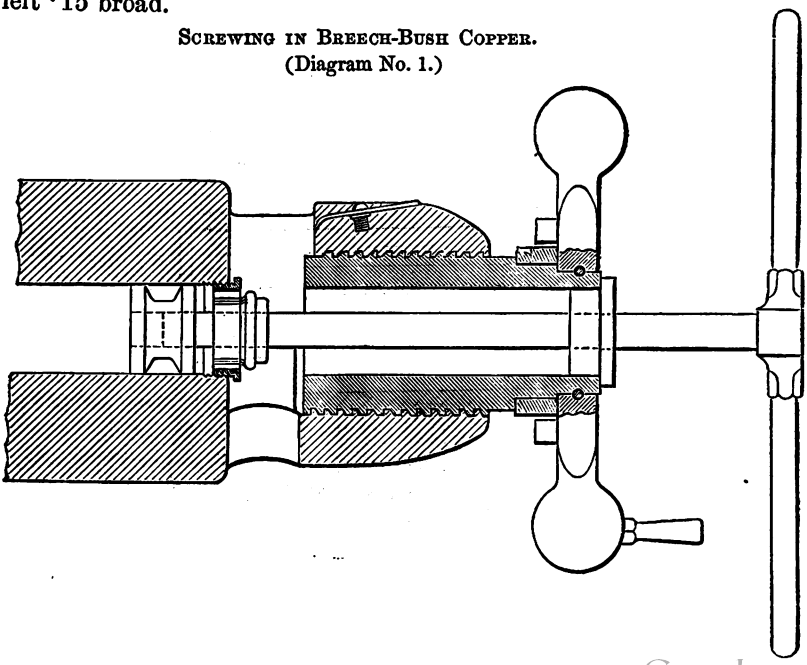
REPAIRS OF R.B.L. (SCREW) GUNS, 40-PR., AND BELOW.

86. Detailed instructions are contained in the boxes of implements issued for re-facing and renewing both the vent-piece copper ring and the breech-bush copper. In the operation of refacing, only just sufficient copper must be removed to render the angle face quite smooth and true.

A bearing is put into the bore in front of the bush for the boring spindle to work upon, and, the face of the breech-bush which is to fit against the A tube being red-leaded, the bush is screwed into the gun as a trial, and on being unscrewed, if the red lead shows it does not fit all round, it is scraped or filed down on the high parts. It is important that the face should fit perfectly tight to the barrel, for if the slightest space be left, the powder gas will eat into it. On being screwed in finally, it is sent well home by striking the lever with a handspike. The ring is then upset with the upsetting block; it is next bored out, the spindle is introduced through the breech screw, there being two bearings in the breech-screw, one in front and one behind, and the knife is fixed through the spindle in the vent slot; the spindle is turned by a wrench and fed to its work by means of the breech-screw. After boring, a different tool is fitted through the spindle, and the copper is faced to within ·03 of an inch of the face of the A tube, the cone part being left ·15 broad.

SCREWING IN BREECH-BUSH COPPER.
(Diagram No. 1.)



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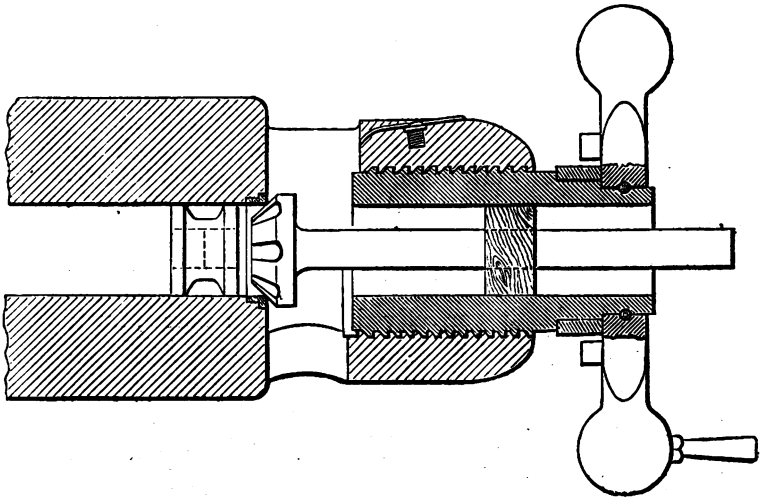
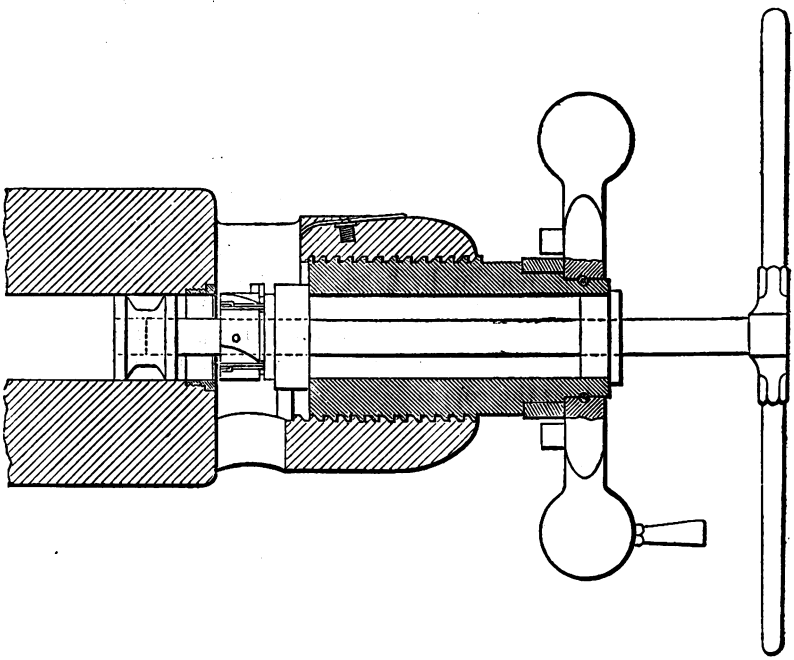
SETTING UP BREECH-BUSH COPPER.
(Diagram No. 2.)



BORING AND FACING BREECH-BUSH COPPER.
(Diagram No. 3.)



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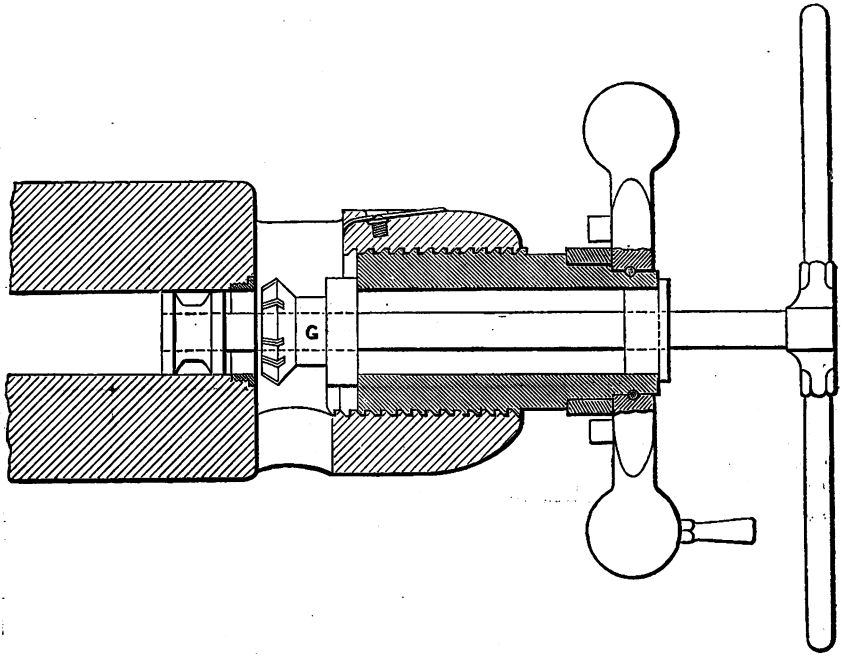
ANGLE-FACING BREECH-BUSH COPPER.

(Diagram No. 4.)



The vent-piece copper ring can be repeatedly refaced until the angle face and the back edges meet. After this it can be removed by striking it a few smart blows with a hammer on the cone face, when it is so expanded that it flies off. The new one is put on by hand, and, the vent-piece having been placed in the gun front to the rear, the ring is forced on by screwing up the breech-screw. It is well to place one of the guide blocks in the face of the breech-screw to prevent its injuring the copper.

Refacing vent-piece.

Fitting new copper ring.

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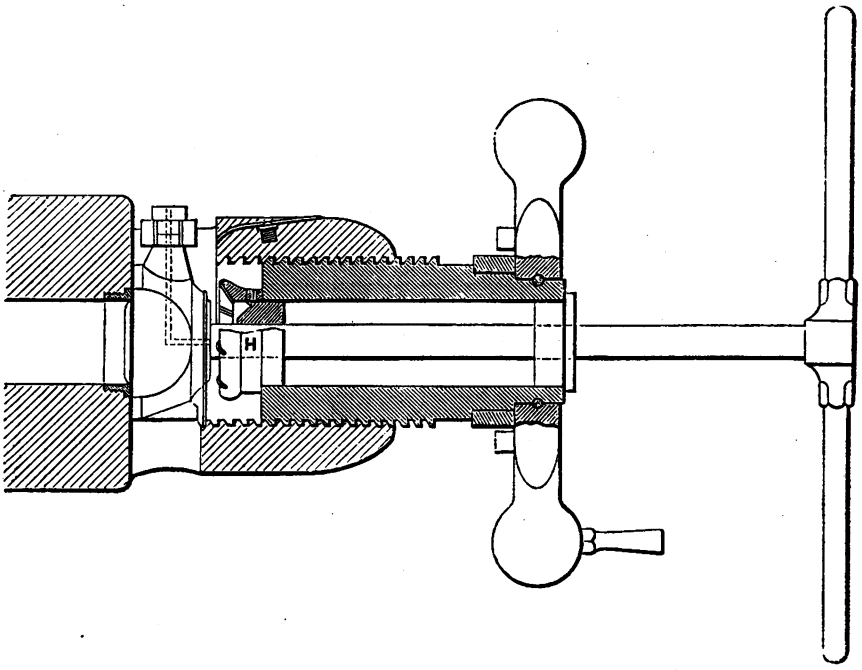
The operation of refacing is shown in the diagram below; the facing tool forming a conical face exactly fitting into the hollow made in breech-bush.

ANGLE FACING VENT-PIECE RING.
(Diagram No. 5.)



REPAIRS OF R.M.L. GUNS.

RE-VENTING.

With Cone Vent.

87. The gun having been conveniently levelled on the carriage, a piece of canvas is placed on the breech of the gun, and the drill-post is then placed upon it (Plate XII.). The object of the canvas is to prevent the gun being marked or bruised, and to keep the drill-post from slipping.

Plate XII.

The wire, directing, is then passed down the vent channel and the screw of the drill-post adjusted directly over it. The drill-post is then made fast by passing the chain round the gun, fixing it to the base of the drill-post, and then firmly tightening it by means of the attached screw clamp.

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OPERATION OF REVENTING WROUGHT IRON RIFLED M . L . ORDNANCE

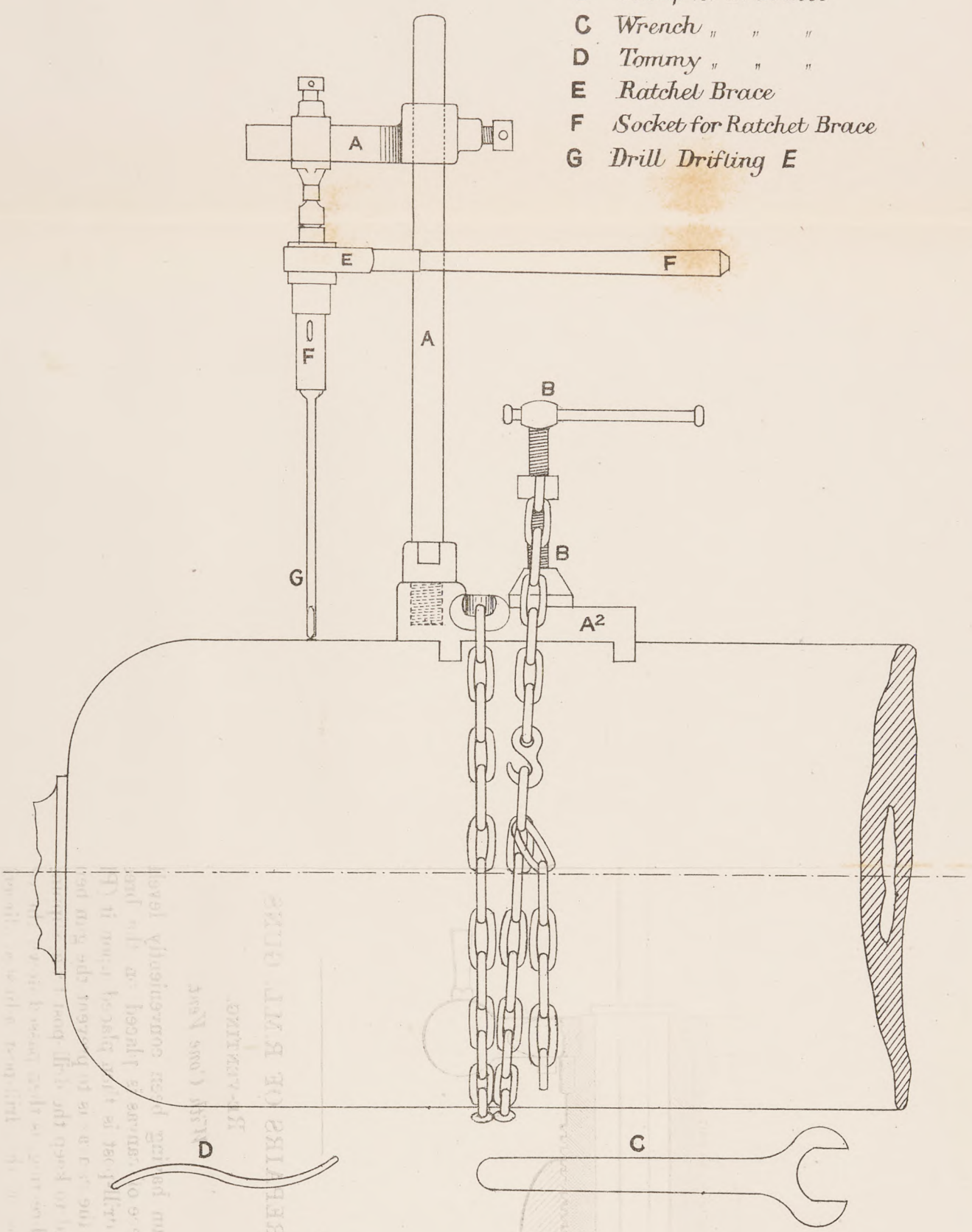
SKETCH SHEWING DRILL POST AND RATCHET BRACE

IN POSITION ON A 64 PR. 64 CWT R. L. M. GUN.

SCALE $\frac{1}{8}$

References.–

A *Drill Post* { A^1 *Gross-head* / A^2 *Foot plate*
B *Clamp for Drill Post*
C *Wrench* " " "
D *Tommy* " " "
E *Ratchet Brace*
F *Socket for Ratchet Brace*
G *Drill Drifting E*



To face page 94.

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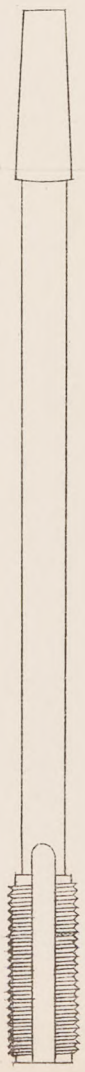
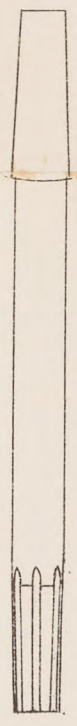
DRILL DRIFTING E.

DRIFT F.

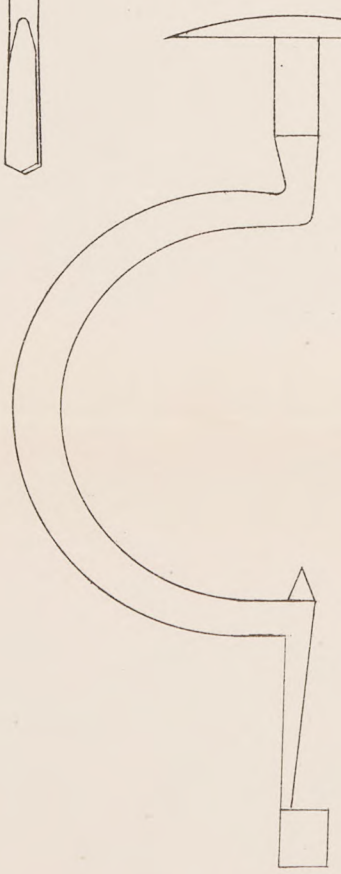
TAP C5.



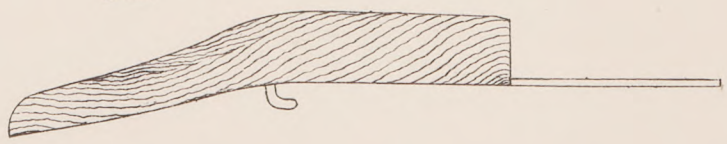
RIMER H.



BRACE ARMOURERS



RIMER FOR MOUTH OF VENT.



BLOCK WOOD FOR Nº 1 INSTRUMENT.

To face page 95.

DANGERFIELD LITH 22, BEDFORD ST COVENT GARDEN 7243.

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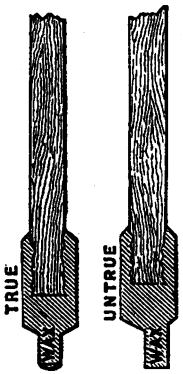
The drill, drifting, E (Plate XIII.) is then placed in ratchet brace and the point of drill into the vent channel. The screw in drill-post is turned down on to the point of the screw into the ratchet brace, when the process of drilling-out can commence. The drill should be taken out after each inch of drilling, the cuttings removed with a piece of bent wire, and the hole cleaned with tow; after which an impression should be taken with wax to ascertain if the drill is cutting correctly. To do this a piece of impression wax * should be worked on the end of a stick of wood sufficiently small to pass down the hole. On being pressed hard against the bottom of the hole and removed it will show whether the channel is concentric with the drilling; should it be Plate XIII.



more on one side than the other (*see* sketch), the drill must be slightly moved to bring the drilling correct.

The drills, drifting, are of different lengths to suit the depths of vents, and should always be passed entirely through the copper bush into the bore, thereby loosening the cone at the bottom.

The drill-post and chain are then removed from the gun and the hole squared at the top, as follows:—

Drive the drift F (Plate XIII.) a little way down to mark the angles for squaring, and with a chisel (hand-graver's) cut away a portion until the hole is squared.

Drive the shortest drift in with a hammer, and unscrew vent; it frequently happens that it comes out in pieces, to meet which case longer drifts are supplied.

There are times when the vent is in so tight that the drift cuts the hole round and so becomes useless; it is then necessary to erect the drilling machine again, and to put the drills, tapping, B down as far as the top of the cone. The

* Beeswax, two parts, treacle 1 part, soft soap one part.

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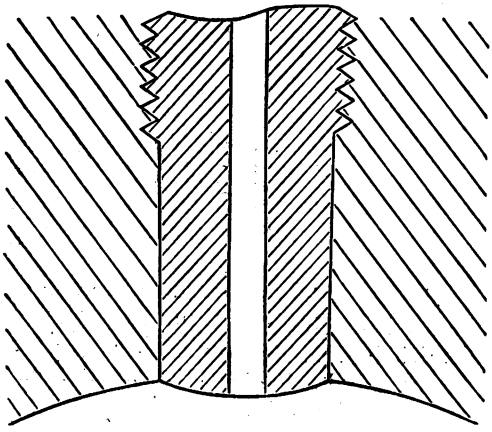
remainder of the thread of vent-bush can then be removed by screwing down the tap C_5 (Plate XIII.), and working it backwards and forwards on going down. The cone portion can be removed by gently hammering a drift F (Plate XIII.) into it and lifting up the shell of the cone.

In all cases the tap C_5 is passed down to clear the thread, but care must be taken not to drive it hard against the top of cone to set it up.

The rimer H (Plate XIII.) is now passed down to remove the burrs, gently turning the wrench.

The hole is then cleaned out with tow, and the new vent carefully fitted, the cone being most important. The vent is screwed tightly down and an impression taken to ascertain the amount projecting in the bore. The position being marked on the top of the vent, it is taken out and filed the proper length and rounded, leaving the cone to project very slightly, front and rear, as in sketch.



The vent is again screwed tightly down in its place and an impression taken; if correct, the top of the vent is cut off and finished. The vent is then rimed out by means of the armourer's brace (Plate XIII.) with rimer vent to allow the vent gauge ·22-inch to pass down. If the gun is for sea service the top of vent must be opened with rimer for mouth of vent (Plate XIII.). The operation is completed by stamping on the top the letter H.

With a Through Vent.

The principle of through-venting a gun is to tap or screw the hole through, thereby doing away entirely with the cone and continuing the thread into the gun, taking care that the bottom of the hole is rather less in diameter than the top, in order to enable the vent-bush to be tightly gripped.

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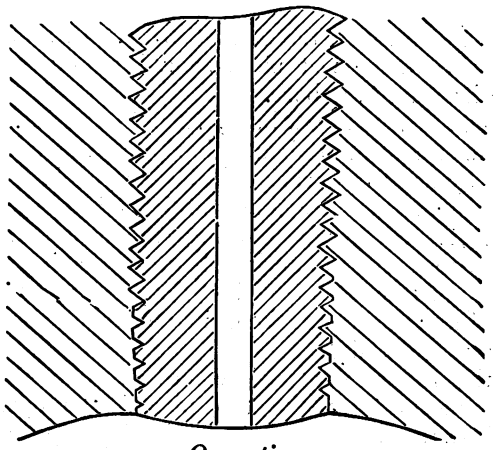

Operation.

The copper vent having been removed, as in the operation of cone-venting, the cone rimer H is passed through to make the hole the tapping size. The depth of the hole is then measured and marked with chalk on the tap C_5, which is gently worked down until the point of the tap is level with the bore of the gun.

The hole is now well cleaned out with tow. The through vent having been rounded at the end, and the proper depth marked upon it, is now screwed down; care being taken not to put too much force upon the wrench, which might cause the vent to break.

An impression is then taken to ascertain if the bush be through. If not, a quarter of a turn at the wrench is taken at a time until correct. Should the bush be too far through, it should be taken out, the surplus metal filed off, and readjusted.

The upper end of the bush is now cut off, and the top of the vent finished; the vent is rimed out to allow the 22-inch gauge to pass down, the bush prepared for sea service, if necessary, and finally stamped with the letter H.

CONVERTED GUNS.

88. S.B. guns converted to rifled guns on the Palliser system are vented in a special manner—viz., by using a through vent of sufficient length to project into the bore, and by upsetting such projecting end into a countersunk recess prepared in the gun.

The old vent is drilled out as before by arranging the drill-post at the angle of inclination of the vent, and by

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means of the drills, with the ratchet brace. In removing the shell of the vent, the last piece should be unscrewed and allowed to drop into the bore.

The thread of a through bush, 12·5 inches in length, is turned off for a length of about ¼ inch, and the bush is then screwed in by hand by means of a lever wrench. To insure that only the required amount projects into the bore, a "*block stop for vent*" is passed into the chamber. This is an iron block attached to an iron bar, and having a portion slotted away of the depth sufficient for projecting part of the bush to fit into; the bar is kept in centre of the bore by means of two wood discs.

When the end of the bush comes in contact with the bottom of the slot on the "stop, block," the operation of screwing is discontinued, and the projecting copper "upset" into the recess as follows.

A split head or "*expanding block*" of wrought-iron, fitting the shape of the chamber, is pushed up into the latter by means of an iron "*extracting hook*"; into that part of the block immediately under the copper bush a piece of hard steel is dovetailed. An iron tube called *guide cylinder*, the inner end of which fits over the "expanding block," is next passed up the bore, and through this guiding tube is passed a solid iron *wedge*, which being forced into the "split head" or "expanding block" presses out the sides of the latter, and so sets up the copper into the recess in the cup. The wedge is at one end of a stout iron bar, the outer end of which is struck by a "*hammer monkey*," slung from above, worked by two or three men, as a considerable amount of power is required for the setting up of the hardened copper bush.

To keep the bar to which the wedge is attached in the centre of the bore, it passes through a "*wood collar*," and also through the centre of a "*cross bar*" in front of the muzzle, which is retained in position by a frame consisting of two rods with loops fitting over the trunnions and secured by nuts and screws to the ends of the collar.

When the copper is sufficiently "set up," the bars are loosed from the collar and the latter removed. The wedge and cylinder guide are then withdrawn and the expanding block removed by the extracting hook, after which a gutta-percha impression is taken of the bottom of the vent to ascertain if the operation has been performed correctly; in that case the copper should still project into the bore for about 0·05 inch.

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RULES FOR FURNISHING ANNUAL RETURN.

89. Returns of ordnance, on Army Forms G 872, for M.L. rifled, and G 925 for B.L. rifled guns, will be sent yearly, by officers commanding vessels of war of every description having ordnance on board, and likewise Royal Marine Artillery, Royal Marines, Royal Naval Reserve, Coast Guard, and Royal Naval Artillery Volunteers, having ordnance in their charge, will furnish returns on 1st January, through the Admiralty, to the Secretary of State for War. These annual returns are forwarded to the Superintendent Royal Gun Factory for report and record. Annual return.

It is necessary for the identification of ordnance that the descriptive marks should be accurately entered in this return. Descriptive marks.

The weight is marked on the top of the piece in front of the vent. Weight.

The initials of the factory will be found on the left trunnion in all cases, and on rifled ordnance the numeral of pattern of mark is also on that trunnion. Initials of factory.

The register number and date of proof will be found on the left trunnion in the case of rifled ordnance, except in the 7-pr. R.M.L., where this information is found on the right trunnion. Register number and date of proof.

Under the head of "Nature," the proper designation of the gun, with its nominal weight, will be entered—as for instance: "9-inch R.M.L. of 12 tons," "40-pr. R.B.L. of 35 cwt." Nature.

The column headed "Date of last Examination" will be filled in from the date of the last inspection made by an Inspector of Warlike Stores or other qualified Examiner. Date of last examination.

The "Condition of bore," and "Sentence," will be taken from the last report made by the Inspector of Warlike Stores, or other examiner conducting the periodical or special examinations ordered; but if the ordnance has not been examined, owing to only a few rounds having been fired from it, these columns may be left blank, unless the Commanding Officer should see cause to call special attention to the piece. Condition of bore and sentence.

The "number of rounds fired" at the date of making the return will be very carefully entered under the several headings; it is exceedingly important, for the sake of the record, that the number should be given correctly. The number of rounds fired with projectiles since previous examination should also be given. Number of rounds fired to be entered in return.

The number of rounds fired at the time of making the annual returns will be very carefully recorded from year to year. In the column in the middle of the return should be inserted the number of rounds fired since last examination. Also to be recorded from year to year.

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Condition of fittings and vents.

The columns regarding the condition of the fittings and obturation of the breech-loading guns, and the vents of muzzle-loading ordnance, will be filled in from the reports of the Inspector of Warlike Stores or other examiner.

Column for "Remarks."

Particulars of any special defect on the exterior or other part of the ordnance will be noted in the column for "Remarks" if not entered in any other part of the return; as also any peculiar circumstance, such as the re-venting of a muzzle-loading gun, the bursting of a shell in the bore, the fracture of fittings, &c. Reference will be made, when necessary, to explanatory documents.

Ordnance not fired since previous return.

Ordnance which have not been fired since the previous return will be entered in the return; but the columns headed "Condition of bore," "Sentence," "No. of rounds fired," and "Condition of Fittings," need not be filled in, but the date when the piece was last fired will be entered in the column for "Remarks."

PRESERVATION OF GUNS.

Exterior.

No outside part of a gun is to be burnished or kept bare, except the faces of the muzzle and trunnions and the rear face of the cascable.

The underneath parts of which cannot be readily got at by the crew during the ordinary cleaning are to be painted; the others may be coated either with oil or paint.

Bore.

The bore, after the removal of the lacquer, is to be kept cleaned and oiled.

The gas escape channel is always to be kept clear.

Vent-sights.

Care must be taken to prevent the vent becoming choked.

The sights are to be kept clean, free from grit, and oiled. The sliding leaf as well as the collars of the centre-fore and trunnion lights should have free play.

The exposed portions of the sights are either bronzed or blued to preserve them from corrosion, and on no account are these parts to be burnished or cleaned in such a manner as to remove the bronzing or blueing more than it is of necessity worn off by fair wear. (For mode of performing these operations, see Text Book of Ordnance, Appendix II., p. 377.)

When the sights are removed from the guns, the recesses are to be filled up with greased tow, or white lead and tallow.

Small gear.

When the friction tube pins guide plate or elevating plates are taken off, the preserving screws are to be inserted.

After firing, the bores of the gun are to be cleaned with fresh water and brushes, then dried and oiled.

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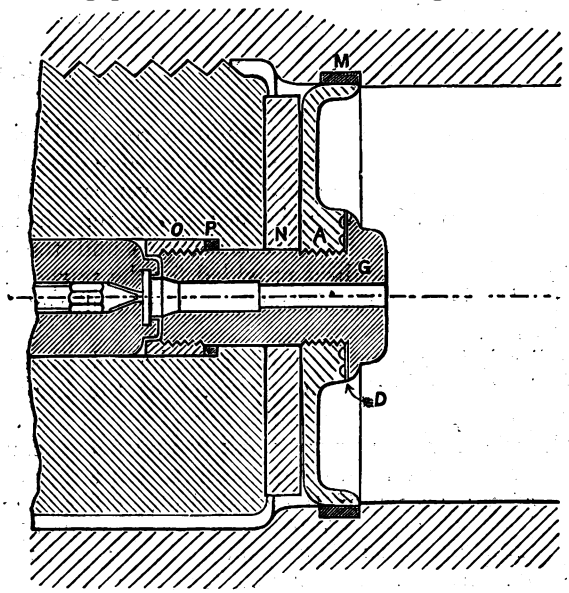
When a gun is to be stowed away in any place where it cannot be examined, it is to be coated with a mixture of hot tar and tallow; after washing the bore with fresh water and carefully drying it, a wad dipped in a mixture of white lead and tallow is to be placed about a foot within the muzzle, the tow pin is then to be well driven in and surrounded with putty, and the vent securely plugged. Preservation when stowed away.

THE ELSWICK OBTURATOR.

The system of obturation adopted for certain of the new breech-loading guns is shown in the drawing attached. Obturator for 6″ 80-pr. guns.



1. It consists of a steel cup A which bears against a copper seating M let into a groove at the rear of chamber; this ring is made of tough copper, and is expanded into the groove, and bored to fit the cup A by means of special tools.

2. The back of the cup A is flat, but rests on the curved face of the steel disc N; when the pressure of the gas acts on the cup it is bent over the curved surface of the disc and expanded in circumference, fitting tightly the copper seat, and thus preventing any escape of gas.

3. The cup and disc are fixed to the breech-screw by the vent bolt G; the cup A is screwed on to G, which is inserted into the breech-screw and fixed with the nut O and spring washer P.

NOTE.—For instructions for replacing obturating cup of 6 81 cwt., Mark II. guns, *see* 82.

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4. When it is required to replace the obturating cup by another, unscrew the nut O with the forked key supplied for the purpose. In this case care must be taken to replace the disc N with the engraved side next the breech-screw.

5. The cup A should be adjusted to bear against the shoulder in the gun; this can be tested, in closing the breech, by moving the lever of the breech-screw slowly until the cup is in contact with the shoulder in the gun; the lever at this point should, with 6-inch guns, be about 0·5* from the stop, so that some force is required to fully close the breech by bringing the lever against the stop.

6. With ordinary care the cup and copper seating are not liable to injury, but should the edge of the cup accidentally get burred or notched, it should be replaced with a spare one. Slight injuries to the edge of the cup can generally be removed with a dead smooth file.

7. If the flat face of the cup should by repeated firing lose its flatness and become hollow, so that the edge does not bear against the shoulder in the gun, and the lever can be brought against the stop without resistance being felt, it may be packed up by inserting between the cup A and the disc N one of the small copper discs provided for the purpose.

These discs are of two thicknesses to meet different degrees of hollowness.

The disc D between the cup A and the bolt G should be reduced in thickness the same amount as the disc inserted between the cup A and the disc N.

8. Occasionally a cup may crack from various causes, or expand permanently from being too soft. In either case the opening of the breech of the gun will be difficult, but the screw can be withdrawn by driving a wooden wedge between the lever and the breech of the gun, or by using a tool made specially for this purpose. If the cup is cracked or expanded it should be exchanged for a new one; the copper seating in the gun should also be carefully examined to see that it has not been injured.

9. It may happen after repeated firing that the copper seating for the obturating cup will become expanded; this is caused by the copper becoming condensed, or being more perfectly forced home into the groove than was accomplished at proof. If the ordinary-sized cup be used under these circumstances, it may become injured from not receiving sufficient support from the seating. Two cups 0·005 inch larger in diameter are supplied with each gun, and when it

* This distance varies according to the nature of gun—with guns smaller than 6-inch it will be less than 0·5 inch, and with larger guns more. The screw stop is adjustable to obtain the proper degree of tightness, but a limit of 0·2 inch either way should not be exceeded.

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is found by trial that one of these can without difficulty be entered into the copper seat it should be substituted for the smaller size.

10. When the gun is not in use the cup should be removed from the breech-screw and kept in a dry place, oiled, and free from rust.

11. A wood lever is supplied to close and open the breech-screw should it be a little tight; there is also a claw on the small end of this lever to start the needle holder after firing if required.

TOOLS.

List of Tools and Stores for Examining Rifled Ordnance.

Bits, vent.	
Armstrong	1
23-inch	1
12-inch	1
Brushes, gun, piasaba, with staves, for each nature of ordnance	1
Compasses	1
Gauges, breech-screw, for each nature of B.L. gun	1
Gauges, vent.	
24-in. long, ·22, ·25, ·275, ·3, set of	4
12-in. long, ·22, ·25, ·275, ·3, set of	4
4-in. long, ·2, ·175, ·16, ·15, (6-inch 816 Mark II. B.L. gun only) set of	4
Gutta-percha, according to armament. No. 1	1
Instruments, taking impressions of bores without plate — No. 2	1
Instruments, taking impressions of bores without plate — special for 16-in., 80-ton	1
Lamp, tin, with rod, large	1
*Plates for instruments taking impressions of bores. for each nature of gun on board	1
Prickers — common, with pan	1
Prickers — with blunted point	1
Scale, diagonal, brass, 12-in.	1
Straightedge testing breech-screw and vent-pieces (R.B.L. screw guns)	1

* If any of the guns are chambered, a plate for the chamber will be required in addition to that for the bore.

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List of Facing Implements for Rifled B.L. Screw Guns.

12 and 9-pr.

In a box, with hinges and hasps, and padlock with two keys.

	Letter.	No. of each.
Blocks — breech-bush copper — angle facing	I	1
Blocks — breech-bush copper — finish boring 3·125 diameter	F 1	1
Blocks — breech-bush copper — finish boring 3·2 diameter	F 2	1
Blocks — breech-bush copper — screwing in	D	1
Blocks — breech-bush copper — upsetting	C	1
Blocks — vent-piece ring, angle facing	J	1
Guard, wood, for vent-piece	S	1
Guides — in breech-screw	M	2
Guides — in powder chamber 3·125 diameter	N 1	1
Guides — in powder chamber 3·2 diameter	N 2	1
Guides — wood (block upsetting), two parts	R	1
Key, for fixing knives	O	1
Knives, breech-bush copper — cutting out	K	1
Knives, breech-bush copper — facing	G & G 1	2
Knives, breech-bush copper — rough boring	E	1
Lever	B	1
Punch, for pin in spindle	P	1
Spanner, for stop washers	Q	1
Spindle	A	1
Washers, stop	L	2

20-pr.

In a box, with hinges and hasps, and padlock with two keys.

	Letter.	No. of each.
Blocks — breech-bush copper — angle facing	K	1
Blocks — breech-bush copper — finish boring 3·875 diameter	I 1	1
Blocks — breech-bush copper — finish boring 3·94 diameter	I 2	1
Blocks — breech-bush copper — screwing in	G	1
Blocks — breech-bush copper — upsetting	M	1
Blocks — vent-piece ring, angle facing	L	1
Guard, wood, for vent-piece	P	1
Guides — in breech-screw	C	2
Guides — in powder chamber 3·875 diameter	D 1	1
Guides — in powder chamber 3·95 diameter	D 2	1
Guides — wood (block upsetting), two parts	Q	1
Key, for fixing knives	N	1
Knives, breech-bush copper — cutting out	F	1
Knives, breech-bush copper — facing	J & J 1	2
Knives, breech-bush copper — rough boring	H	1
Lever	B	1
Punch, for pin in spindle	R	1
Spanner, for stop washers	O	1
Spindle	A	1
Washers, stop	E	2

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40-PR.

In a box, with hinges and hasps, and padlock with two keys.

	Letter.	No. of each.
Blocks { breech-bush copper { angle facing	G	1
cutting out	D	1
finish { 4·91 diameter	F 1	1
boring { 4·96 diameter	F 2	1
screwing in	E	1
upsetting	M	1
vent-piece ring, angle facing	H	1
Collar for feed motion	B	1
Guides { in breech-screw	A	1
in powder chamber	C	1
wood (block upsetting), two parts	N	1
Handle to hold blocks in vent chamber	P	1
Lever	J	1
Punch for { knives in blocks	K	1
pin in spindle	L	1
Spanner for stop washers	R	1
Spindle	I	1
Washers { feed	O	1
stop	Q	1

TOOLS, RE-COPPERING B.L. GUNS, 6-INCH (80-PR.).

Nature of Article.	No. of each.
Blocks { Guide, with pinion-shaft wheel, and 2 spindles	1
No. 1, with 2 knives	1*
No. 2, in 3 parts	1
No. 3	1
No. 4	1
No. 5	1
No. 6	1
Chest, complete, with hinges, hasp, padlock, and 2 keys	1
Cup, obturator, expanding copper ring	1
Drift	1
Pinion, with handle	1
Spanner	1
Spindle block, No. 3, with lever	1
Tommy	1

* And 1 spare knife of each nature.

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A similar set, bearing the same designation, is also required for each of the following natures of B.L. guns, viz :—

6-inch 81 cwt., Mark II.

4-inch { 22 cwt., Mark I.
13 cwt., Mark I.

Tools, Repairing, Rifled M.L. Ordnance.

Nature of Article.		No. of each.
Machines, hand rifling, complete, for	12·5-inch guns	1
	11 " "	1
	10 " "	1
	9 " "	1
	7 " "	1
	64-pr.	1

Tools, Special, for Rifled B.L. Screw Guns, Sea Service.

Nature of Article.			No. of each.
Cans, lubricating, smiths			1
Chests, with lock and keys	complete		1
	empty		1
Chisels, cross cut, 18-inch			2
Drivers, screw, bent			1
Files	bastard, knife, 6-inch		4
	second cut, one safe side, square, taper	8-inch	1
		6 "	1
	smooth knife, 6-inch		3
Handles, file	middling		1
	small		3
Punches, steel	13-inch		1
	7 "		1
	6 "		1
	4 "		1
Wrenches, with pins for elevating patches			1

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List of Tools, Re-venting R.M.L. Guns.

Nature of Article.	Ordnance, Muzzle-loading.											Remarks.
	Wrought iron.									Steel.	Converted.	
	12·5-in.	12-in.	11-in.	10-in.	9-in.	8-in.	7-in.	64-pr.	9-pr.	7-pr.	64-pr. 71-cwt.	
Blocks — wood, for No. 1 instrument for taking impressions of vents	1	1	1	1	1	1	1	2*	–	–	1	* 1 block for Mark I., and 1 for Marks II. and III.
Blocks — expanding, pairs, converted guns	–	–	–	–	–	–	–	–	–	–	1	
Blocks — stop for vents, converted guns	–	–	–	–	–	–	–	–	–	–	1	
Blocks — 4-inch, treble and double, with fall, converted guns	–	–	–	–	–	–	–	–	–	–	1	
Braces — armourer's	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	
Braces — ratchet, 12-inch	–	–	–	–	–	–	–	–	*a*	*a*	–	
Braces — „ 20 „	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Brush, gun, soft, small, with stave, in two lengths	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	
Chest, with lock and 2 keys	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	
Chisels, hand — flat, set of five; gouge; gravers, set of three	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	
Cutter, rose, for 64-pr. converted guns	–	–	–	–	–	–	–	–	–	–	1	
Cylinder, guide, for 64-pr. converted guns	–	–	–	–	–	–	–	–	–	–	1	
Drifts, taking out old vents — $\frac{5}{8}$-inch	–	–	–	–	–	–	–	–	–	1	–	
Drifts, taking out old vents — 6 „ / 8 „ / $10\frac{1}{2}$ „	–	–	–	–	–	–	–	–	1	–	–	
Drifts, taking out old vents — F / F1	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Drifts, taking out old vents — F2 / F3 / F4	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Drifts, taking out old vents — F5	*a*	*a*	*a*	*a*	*a*	–	–	–	–	–	–	

a Common to all these.

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Nature of Article.	Ordnance, Muzzle-loading.											Remarks.
	Wrought-iron.									Steel.	Converted.	
	12·5-in.	12-in.	11-in.	10-in.	9-in.	8-in.	7-in.	64-pr.	9-pr.	7-pr.	64-pr. 71-cwt.	
Drill, post (29 inches high, complete with wrench, tommy, clamp, 2 foot plates, and 2 lengths of chain (15 feet each length))	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*		
Drills — cone — $\frac{5}{8}$-inch	–	–	–	–	–	–	–	–	–	1	–	
Drills — cone — $1\frac{1}{8}$ "	–	–	–	–	–	–	–	–	1	–	–	
Drills — cone — G, G1	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	–	
Drills — for venting — drifting — $\frac{5}{8}$-inch	–	–	–	–	–	–	–	–	–	1	–	
Drills — for venting — drifting — 4 ", 10 "	–	–	–	–	–	–	–	–	1	–	–	
Drills — for venting — drifting — E, E1, E2, E3, E4	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Drills — for venting — tapping — $\frac{5}{8}$-inch	–	–	–	–	–	–	–	–	–	1	–	
Drills — for venting — tapping — 4 ", 10 "	–	–	–	–	–	–	–	–	1	–	–	
Drills — for venting — tapping — B, B1, B2, B3, B4	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Drills — hollow — $\frac{5}{8}$-inch	–	–	–	–	–	–	–	–	–	1	–	
Drills — hollow — $1\frac{1}{8}$ "	–	–	–	–	–	–	–	–	1	–	–	
Drills — hollow — A, A1	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	

a Common to all these.

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Nature of Article.	Ordnance, Muzzle-loading.											Remarks.
	Wrought-iron.									Steel.	Converted.	
	12·5-in.	12 in.	11-in.	10-in.	9-in.	8-in.	7-in.	64-pr.	9-pr.	7-pr.	64-pr. 71-cwt.	
Files - bastard, safe edge, with handle, 14-inch	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	
Files - smooth, safe edge, 10-inch	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	
Frame, trunnion, with cross-head, complete, for converted guns (4 pieces)	–	–	–	–	–	–	–	–	–	–	1	
Gauges, vent, 0·22-inch - short	–	–	–	–	–	–	–		*a*	*a*	–	
Gauges, vent, 0·22-inch - long	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Hammers - hand - large	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	
Hammers - hand - small	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	
Hammers - monkey, for converted guns	–	–	–	–	–	–	–	–	–	–	1	
Hook, extracting, expanding blocks, for converted guns	–	–	–	–	–	–	–	–	–	–	1	
Instruments, for taking impressions of vents - wood, No. 1	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Instruments, for taking impressions of vents - iron, in 2 pieces, No. 2	–	–	–	–	–	–	–	–	*a*	*a*	–	
Pans, for taking impressions of vents, for No. 1 instrument - A, large	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	–	–	
Pans, for taking impressions of vents, for No. 1 instrument - B, small	–	–	–	–	–	–	–	*a*	–	–	–	
Pans, for taking impressions of vents, for No. 1 instrument - C, 64-pr. converted	–	–	–	–	–	–	–	–	–	–	1	
Piece, lengthening for No. 1 instrument, for taking impressions of vents for 9-inch to 12·5-inch R.M.L. guns	*a*	*a*	*a*	*a*	*a*	–	–	–	–	–	–	
Rimers - cone - $\frac{5}{8}$-inch	–	–	–	–	–	–	–	–	–	1	–	
Rimers - cone - $1\frac{5}{8}$ "	–	–	–	–	–	–	–	–	1	–	–	
Rimers - cone - H	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	–	
Rimers - cone - H1*												
Rimers - mouth of vent*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	
Rimers - vent - short	–	–	–	–	–	–	–	–	*a*	*a*	–	
Rimers - vent - long	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	

* 26 inches long.

a Common to all these.

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Nature of Article.	Ordnance, Muzzle-loading.											Remarks.
	Wrought-iron.									Steel.	Converted.	
	12·5-in.	12-in.	11-in.	10-in.	9-in.	8-in.	7-in.	64-pr.	9-pr.	7-pr.	64-pr. 71-cwt.	
Saw, with frame, 14-inch	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	
Socket, for ratchet	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Spanner, for countersink of converted guns	–	–	–	–	–	*a*	–	–	–	–	1	
Taps, new thread, short, C1 C2 C3 C4 C5	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Taps, new thread, long, C3 C4 C5	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	–	–	
Taps, old thread, D3 D4 D5	–	–	–	–	–	–	–	–	–	–	*a*	
Vents, copper, cone	4	3	3	4	6	3	10	16	20	12	–	
Vents, copper, through	2	1	1	2	2	1	2	4	4	–	10	
Wedge, expanding, blocks, converted guns	–	–	–	–	–	–	–	–	–	–	1	
Wires, directing, large	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Wires, directing, small	–	–	–	–	–	–	–	–	*a*	*a*	–	
Wrenches, for countersink, converted guns	–	–	–	–	–	–	–	–	–	–	1	
Wrenches, for taps	*a*	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	*a*	
Wrenches, for taps and vents, large	–	–	–	–	–	–	–	–	1	–	–	
Wrenches, for taps and vents, small	–	–	–	–	–	–	–	–	–	1	–	
Wrenches, for vents	*a*	*a*	*a*	*a*	*a*	*a*	*a*	–	–	–	*a*	

a Common to all these.

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De Bange Obturator.

Fig 1.

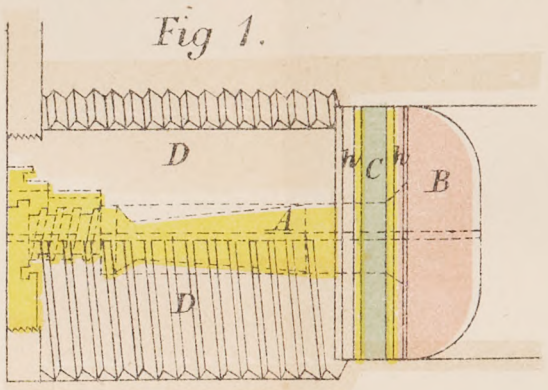
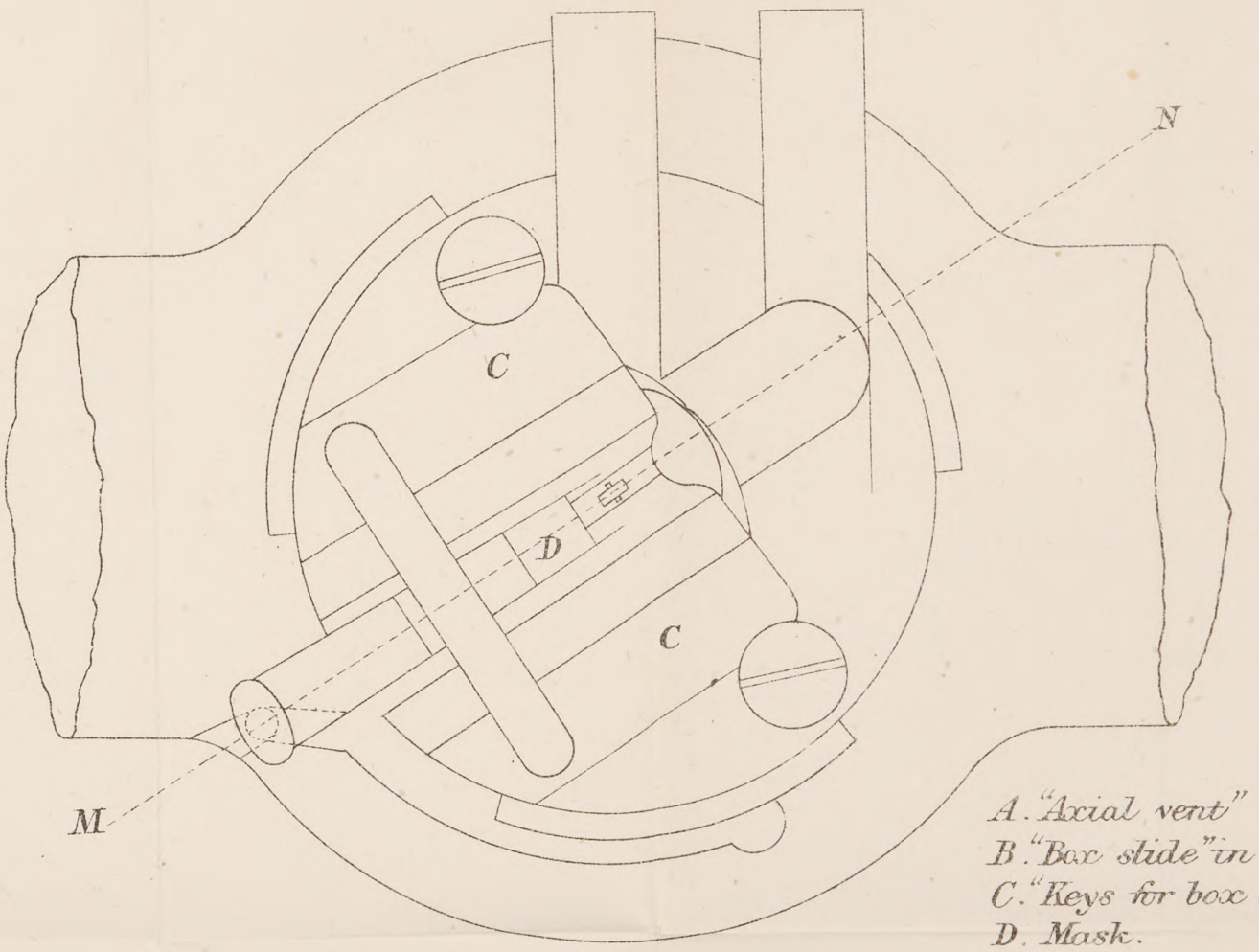
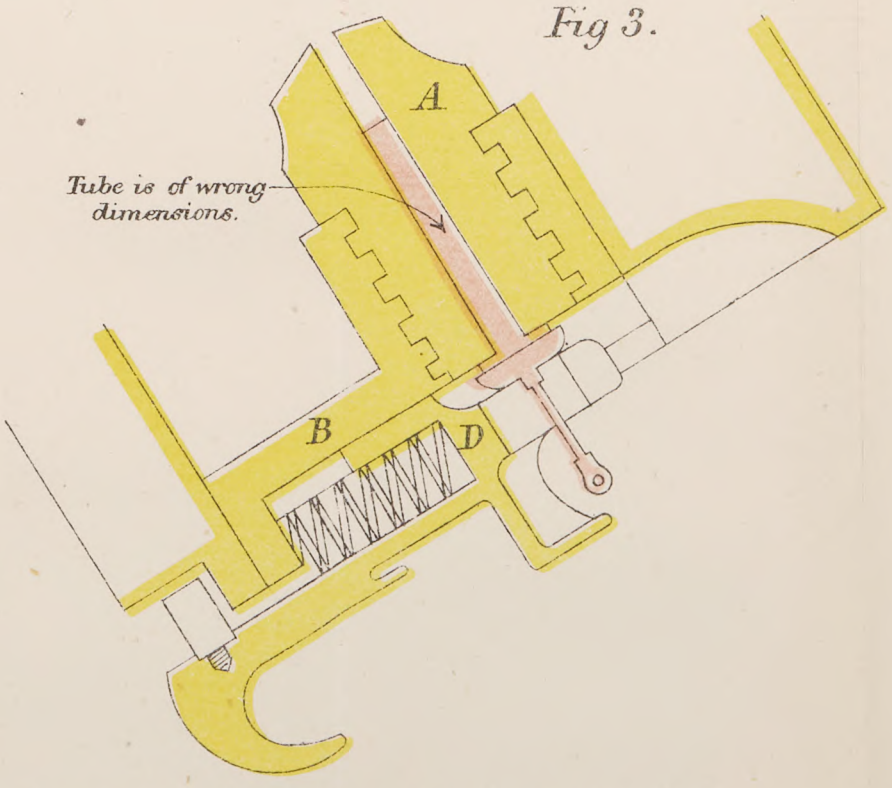


Fig 2.



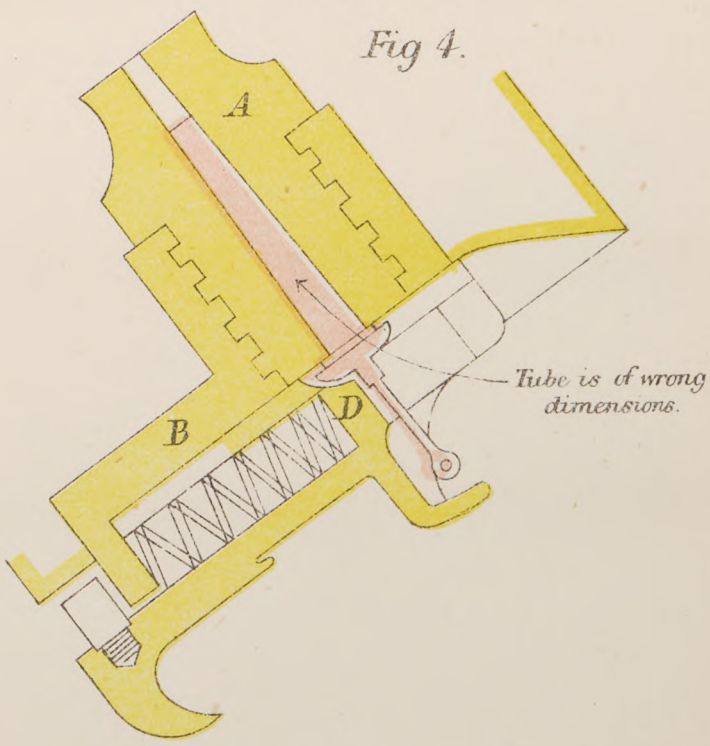
A. "Axial vent"
B. "Box slide" in two parts
C. "Keys for box slide".
D. Mask.

Fig 3.



Section at M.N. shewing tube unmasked.

Fig 4.



Section at M.N. shewing tube masked.

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THE DE BANGE OBTURATOR.

Description.

Plate XIV.

It consists of a stalk A passing through the breech block, being secured to the exterior by means of a joint box in two pieces (shown in Figs. 3 and 4, B); the end of the steel stalk has annular projections on it (A, Figs. 3 and 4), which are clasped by corresponding grooves in the joint box; on the end of the stalk is a mushroom head (B, Fig. 1); over the neck of the stalk between the mushroom head and end of breech block (D, Fig. 1) is placed a wad (C, Fig. 1). This wad is composed of asbestos and mutton fat pressed into shape by heavy hydraulic pressure, secured in a canvas cover, and enclosed between two "compound metal discs" composed of tin plates strengthened at the edges by thin brass rings (*h*, Fig. 1).*

Action of obturator.

On firing, the head is forced back by the pressure of the gas against the asbestos wad and squeezes it out against the walls of the chamber of the gun, thus preventing all escape of gas to the rear. The wad is sufficiently elastic to regain its shape on the cessation of pressure, allowing the breech to be easily opened; to facilitate this, the bore of the gun is slightly coned over the seat of the wad, so on once starting the block to the rear no further opposition will be met from the wad sticking.

R.G.F. vent-masking slide.

Figures 2, 3, 4 illustrate this arrangement. The stalk A passes through the breech screw, and is held by a "slide box" B in two parts, which clutch a series of collars on the end of the "axial vent" (A). The "slide box" is secured by "two keys" C.

The vent-masking slide D prevents the lanyard from being hooked to the wire of the tube until the breech screw has been properly secured in the gun, the slide is pressed forward by a spring, and at the same time a stud moving in an inclined groove in the carrier ring draws it back and gradually unmasks the tube in the act of closing the breech. In rapid firing the pad sometimes becomes soft; when this occurs, it should be taken off and placed in a bucket of water to cool.

These pads are very durable, one gun having fired 3,000 rounds using the same pad.

---

* Steel rings are now being substituted for brass.

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Instructions for the Care and Preservation of the Breech Fittings of B.L. Guns fitted with De Bange Obturator and R.G.F. Vent Masking Slide.

The breech fittings should be taken off about once a month and cleaned and oiled. A special screw-driver is issued for removing these fittings; before doing so, the breech should be opened, and the carrier ring secured with the "retaining latch."

To remove handle. Take out the two "fixing screws," and with a few gentle taps on the handle, slide it down.

To remove obturator. Vent-masking slide. Slide box. The two "slide box securing keys" are taken out by inserting the hook of the screw-driver in the holes at their ends and drawing them backwards; the vent-masking slide and the slide box in two parts are then taken off, the obturator can now be withdrawn from the front of the breech screw.

Lever-releasing breech screw. This lever is hinged by a screw fixing.

To remove the breech screw. When the breech is open, the breech screw is held in the carrier ring by a screw "stop" on the right, and by the spring "carrier retaining clip" on the left; by unscrewing the "stop," and pressing the clip-retaining carrier upwards, the breech screw is released, and can be withdrawn to the rear. When the breech is closed, the "carrier retaining clip" is withdrawn from the breech screw, which can then be removed by unscrewing the "stop" on the right.

In all cases, when the obturator is attached to the breech screw, the withdrawal of the latter from the carrier ring should be done by two persons, as care is necessary to keep the "stop" and "carrier retaining clip" perfectly clear of the breech screw before drawing it back, to avoid damaging the obturator.

Carrier ring. This is attached to the breech of the gun by a hinge pin secured by the screw stop; by taking out this screw and giving a few taps to the hinge pin underneath it can be drawn upwards.

Clip-retaining carrier ring. To remove the "ring carrier retaining clip," take out the "fixing screw," it can then be withdrawn from the slot in the carrier ring.

Latch retaining carrier. This is attached to the carrier ring by two "fixing screws," when these are taken out the "latch" can be withdrawn.

Obturator. The De Bange obturator consists of the axial vent, obturating pad, and compound metal discs.

Russian tallow should be rubbed occasionally on the pad to keep it in good order; it and the metal discs should be

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carefully handled to prevent them becoming bruised; except when taken off for examination they should be kept on the axial vent in the gun, as there is a tendency of the pad to swell, which would cause difficulty in inserting the "slide box."

To Replace.

Replace everything in the reverse order; care must be taken that the compound metal discs are placed in the proper order. The disc *without* the brass ring in the centre is to be next the mushroom head. The cup part of both discs towards the pad. Should the pad require adjusting, "adjusting steel discs" are supplied for the purpose, which are put on the stalk between the inner compound metal disc and the face of the breech block.

4-inch, 22 cwt. B.L. Guns, Marks II. and III.

List of Fittings issued with each Gun and proportion of Spare.

Nature of Article.	With each Gun.	Spare.	
		No.	Remarks.
Box, slide, in 2 parts, with 2 keys (2 keep pins and lanyard bolt with spiral spring*).	1	1	To every 10 or less number of guns.
Band, elevating steel, with: steel pivot and keep pin, R.C.D. carriage.	1	–	
Band, elevating steel, with: 2 elevating pivots vavasseur carriage. 2 keep pins. 1 set screw.	1	–	
Clamps, pinion, for tangent scale - -	2	1	To every 5 or less number of guns.
Clip, retaining, carrier ring, with flat spring, and 1 bolt fixing with keep pin.	1	1	To every 10 or less number of guns.
Discs: metal compound, set of 2 -	1	2	To each gun.
Discs: steel adjusting - -	2	4	" "
Extractor, vent sealing tube - -	1	5	To every 10 or less number of guns.
Handle, breech screw (with 2 screws†) -	1	1	" "
Latch, retaining carrier, with spiral spring and 2 bolts fixing with keep pins‡.	1	1	" "

* For guns fitted for percussion tubes.
† Mark II. guns only.
‡ Guns of H.M.S. "Audacious" have fixing screws instead of fixing bolts with keep pin.

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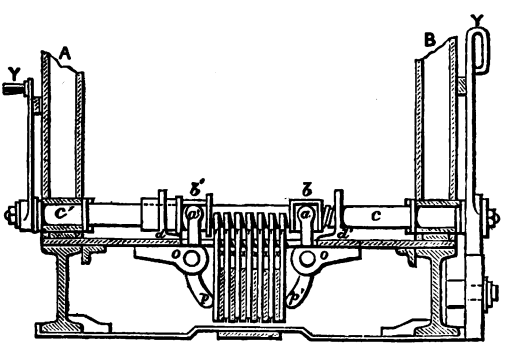
Nature of Article.	With each Gun.	Spare. No.	Spare. Remarks.
Lever, releasing breech screw, bolt, and keep pin.	1	1	To every 10 or less number of guns.
Pad, obturating - - - -	1	3	To each gun.
Rimers, vent, axial - - -	1	5	Every 10 or less number of guns.
Ring carrier, with hinge, bolt,† and keep pin.	1	1	„ „
Screw { driver - - - -	1	–	„ „
Screw { breech - - -	1	1	„ „
Sights { tangent - - - -	2	1	Every 5 or less number of guns.
Sights { trunnion - - -	2	1	„ „
Slide, vent, with 2 spiral springs (3 flat springs with guide pin, striker, hammer, and guard*).	1	1	Every 10 or less number of guns.
Springs { flat clip-retaining carrier -	–	1	To each gun.
Springs { flat slide vent (1 hammer, 2 guard)	–	3	„ „
Springs { spiral, latch retaining carrier -	–	1	„ „
Springs { spiral, slide vent (1 striker, 1 guide pin.	–	2	„ „
Vent, axial - - - -	1	1	To every 10 or less number of guns.

CARRIAGES AND SLIDES.

The names of parts and fittings are given in the Gunnery Drill Book, p. 63.

The Elswick Compressor.



* For guns fitted for percussion tubes.
† Mark II. guns only.

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Double Plate.—Service Pattern with Elswick Compressor connected Screw Shaft.

Description. Long flat bars, *x*, *x*, *x*, are placed between the sides of the slide, and are attached to it at their inner and outer ends by means of a bolt passing through them, which allows motion to the bars. Short plates, *r*, *r*, *r*, of the same depth pass through and are attached to the lower part of the carriage; these plates fit into the spaces between the bars in the slide, and the whole can be compressed tightly together by means of short levers, *p*, *p*, (called rocking levers) acting on the two outside plates in the carriage, and which are worked by means of lever handles on a threaded shaft, *c*, called the compressor shaft, which passes through the brackets of the carriage. After the gun is run out, the whole of the bars are compressed tightly together by the levers; very considerable friction is thus caused on recoil, and is continued until the whole force of the recoil is expended and overcome.

On moving the compressor lever handle, both rocking levers are worked; the adjusting lever can be set to any degree of compression, without causing any motion in the compressor shaft and lever.

The efficient working of the compressor is a most important point, and depends on the careful management of the adjusting and compressor levers.

Adjustment. The compressor lever should, when using battering charges, be placed in the catch, and the adjusting lever keyed in such a position that the compressor lever can just be moved by hand. With full charges, the adjusting lever should be slacked back one hole.

Placing and Adjustment.

First fix rocking levers *a p*, a^1 p^1, to the bottom of carriage by the pins *o*; then place compressor plates *r r* and secure them; lift the rear part of carriage and pass compressor bars *x x* between the plates, and place bar pins; then lower the carriage, place the compressor nut *b* on the head of right rocking lever, thick part towards the centre; place the adjusting cylinder b^1 in the left rocking lever; put in and key the adjusting spindle c^1, placing on the collar; then pass compressor shaft *c* through right bracket, through collar, through the compressor bracket d^1, and nut; then turn both shafts inboard with spanners, turning the adjusting spindle twice and compressor shaft once; when far enough through, key the compressor shaft, and set the rocking levers close to the plates by turning the right shaft inboard and the left

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outboard. After this, work the shafts until the distance from carriage bracket to inside part of adjusting cylinder on the left is equal to that from carriage bracket to inside part of compressor nut on the right, the compressor being taut; then put on compressor lever y below the catch, and adjusting lever y^1 as near as possible to the third hole from the bottom of the adjusting arc.

Description.

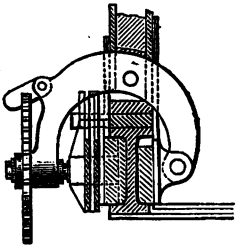
The Bow Compressor.

The compressor is constructed to act on each side, and comprises a bow or cramp, which passes through the bracket, and is supported by a pin; the outer part of the cramp is fitted to take an adjusting screw and wheel. The wheel is notched to receive a paul, which keeps it in any required position, and is fitted with two handles (not shown in sketch) secured by thumb screws, and has a brass arc fixed upon it marked in numbers and fitted with a sliding pointer by which the compression last given is indicated. There are four plates suspended from the carriage, and two long bars to each side of the slide; these usually taper, the former downwards, and the latter upwards. The sides of the slide are filled in with wood, and thus act as a third compressor bar on each side.

These fittings vary in some turret ships.

Care in working.

Great care should be taken that the gun is off the rollers before the compressor is set up for firing. In slacking the compressor not more than about half a back turn should be taken with the wheel, as if a turn be taken the pointer might be brought to the paul without the compressor being set up.



Bow Compressor.—Scale about $\frac{1}{28}$ of full size.

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Directions for Dismounting Compressor of 6-inch B.L. Guns, Elswick Mounting.

To Remove the Compressor.

1. Place the carriage so that the rear ends of compressor plates are just in front of centre bottom plate of slide and secure the carriage.

2. Ease up the compressor and remove both compressor bar pins, take out compressor bars, hauling them to the rear, commencing with the studless ones.

3. Push the compressor plates to the left.

4. Remove compressor lever and disc, and take out the bearing on the right.

5. Push the compressor shaft to the left and run the right nut off its thread, take off the cap on the left of shaft, haul the shaft out through the right bracket of carriage, turning it round so as to remove the left nut. If necessary the compressor plate bar can now be removed and the plates lifted out over all.

To Replace the Compressor.

1. Put in the compressor plates, resting the front ends on the bottom plate of carriage, replace compressor plate bar.

2. Pass compressor shaft through the right bracket of carriage and slip the right nut over the end of the shaft, place the left nut on the head of left rocking lever, pushing the shaft to the left, enter it in the left nut, turning the shaft round until the left nut is close up to its thread.

3. Run the right nut up till the first thread shows on the inner surface of the nut, haul the shaft to the right, fix the right nut on the head of right rocking lever, put on the cap on the left.

4. Put in the compressor bars, the studded ones first, replace compressor bar pins, front and rear.

5. Replace the bearing on the right, put on the compressor lever and disc, then adjust the compressor.

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Capstan Head Elevating Gear.

Placing in position.

In putting on this elevating gear, the pinion with spindle, capstan, jamming lever, will fit on either bracket, but the pinion with spindle must be placed so that the lever will clamp by turning it to the rear.

The pinion spindle is placed through the bracket from the inside, the capstan placed on the spindle outside the bracket, boss inwards, the feathers entering the feather-ways in the spindle, and the jamming levers placed on. These articles are placed similarly on each bracket.

The elevating arc may be placed on either before or after the gun is mounted, but it is more convenient to place it on after the gun is mounted; it is less likely to be damaged, and better out of the way. In the case of the 10-inch, however, it must be placed before the gun is lowered into the slide.

The top of each arc is marked "top," and should be placed accordingly.

The arc is pivoted to the patch on the gun by a screw, which is marked R. or L. (right or left), and when the screw is screwed home, a keep-pin is placed vertically through it and the patch.

Wheel Elevating Gear.

Instructions for Removing.

Wheel gear, removing.

Give gun extreme depression and lash cascable to beams overhead, or chock breech of the gun up so as to take weight off the elevating gear.

Then proceed as follows:—

1. Remove hand wheel.
2. Remove nuts of jamming lever and take off the lever.
3. Remove nuts and take off the top bearing of jamming lever bracket.
4. Take out screws and remove inclined plane on jamming lever bracket.
5. Take out the jamming bolt.
6. Remove jamming lever bracket.

Note.—This can be done, with a little difficulty, without dismounting the gun.

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7. Knock out keep-pin of elevating arc from underneath.
8. Take out screw and remove elevating arc.
9. Remove shields of motion-wheels.
10. Remove motion-wheels in following order :—
    1st, 2nd, 3rd, and 4th.
    NOTE.—1st and 3rd motions are attached to spindles; 2nd and 4th are kept on by a screw bolt and washer.
11. Take out elevating pinion attached to spindle.

To Replace.

Before replacing any part of this gear, spindles, screw bolts, &c. should be coated with a mixture of tallow and Rangoon oil. White lead is liable to harden and set, and should not be used. Replacing.

It will be most convenient to replace the gear in the following order :—

1. Elevating arc screw and keep-pin.
2. Elevating pinion and spindle.
3. Bracket for jamming lever.
4. 4th motion-wheel over feathers on elevating spindle, washer, and screw bolt.
5. 3rd motion-wheel on spindle, washer, and nut, inside carriage.
6. 2nd motion-wheel, washer, and screw bolt.
7. 1st motion-wheel on spindle, washer, and nut.
   NOTE.—This spindle should be coated with lubricating oil only.
8. Shields of motion-wheels.
9. Hand-wheel.
10. Place jamming bolt through elevating arc, and put on top bearing of jamming lever bracket.
11. Inclined plane on bracket.
    N.B.—The screws for fixing this plane are of different lengths and, consequently, not interchangeable. The rear screw is the shortest.
12. Jamming lever washer, adjusting and set nut, and adjust for proper amount of friction.

The only portions of this gear which are interchangeable either side of carriage are,—motion-wheels, jamming bolt, and the elevating wheel.

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Preservation of Carriages and Slides.

Iron carriages and slides are to be painted with magnetic paint when procurable, and otherwise with ordinary paint, and none of the fixed parts are ever to be burnished or kept bright.

The whole of the working parts of the carriages and slides are to be taken apart and thoroughly cleaned once a month.

The slides are to be lifted every six months, or oftener, and the under and interior surfaces of the slides and carriages thoroughly cleaned, all rust being removed by scraping.

General. All nuts should be kept tightened up, and all bearings and parts of gear which work one upon another well lubricated and free from clotted oil and rust. Care should be taken that none of the loose parts of gear become indented by being thrown down or by striking one against another, or with a hammer; no hammer should be used in putting on loose parts.

Should a screw go very tight it should be withdrawn and examined, and if it is found that the bearing or screw has been indented, the burr should be carefully removed with a file.

Rollers. The carriage-rollers should revolve freely upon their axles, and only take a bearing on the platform when the eccentrics are thrown into gear. The eccentrics not being in action, the front rollers have a clearance of ·02 inch and the rear of ·1 inch, which is a very small amount, and consequently should the axles of the front rollers become but slightly bent, the carriage in running up, instead of moving on its rollers, will slide. From this it follows that the straightness of the front axles has to be attended to.

Buffer blocks. The faces of the buffer blocks upon the carriage and platform should be parallel one to the other, or else the spindles of the buffers are liable to be twisted.

The friction roller of the elevating-gear is liable to be set fast by corrosion; if so, it must be carefully removed and cleaned.

The frictional surfaces of clamps, and jamming levers, should be kept clean, but not oiled.

All bearings and frictional parts of gear, except those named, must be kept properly oiled.

A carriage fitted with the hydraulic buffer should never be fired from unless it has clips, and before such a carriage

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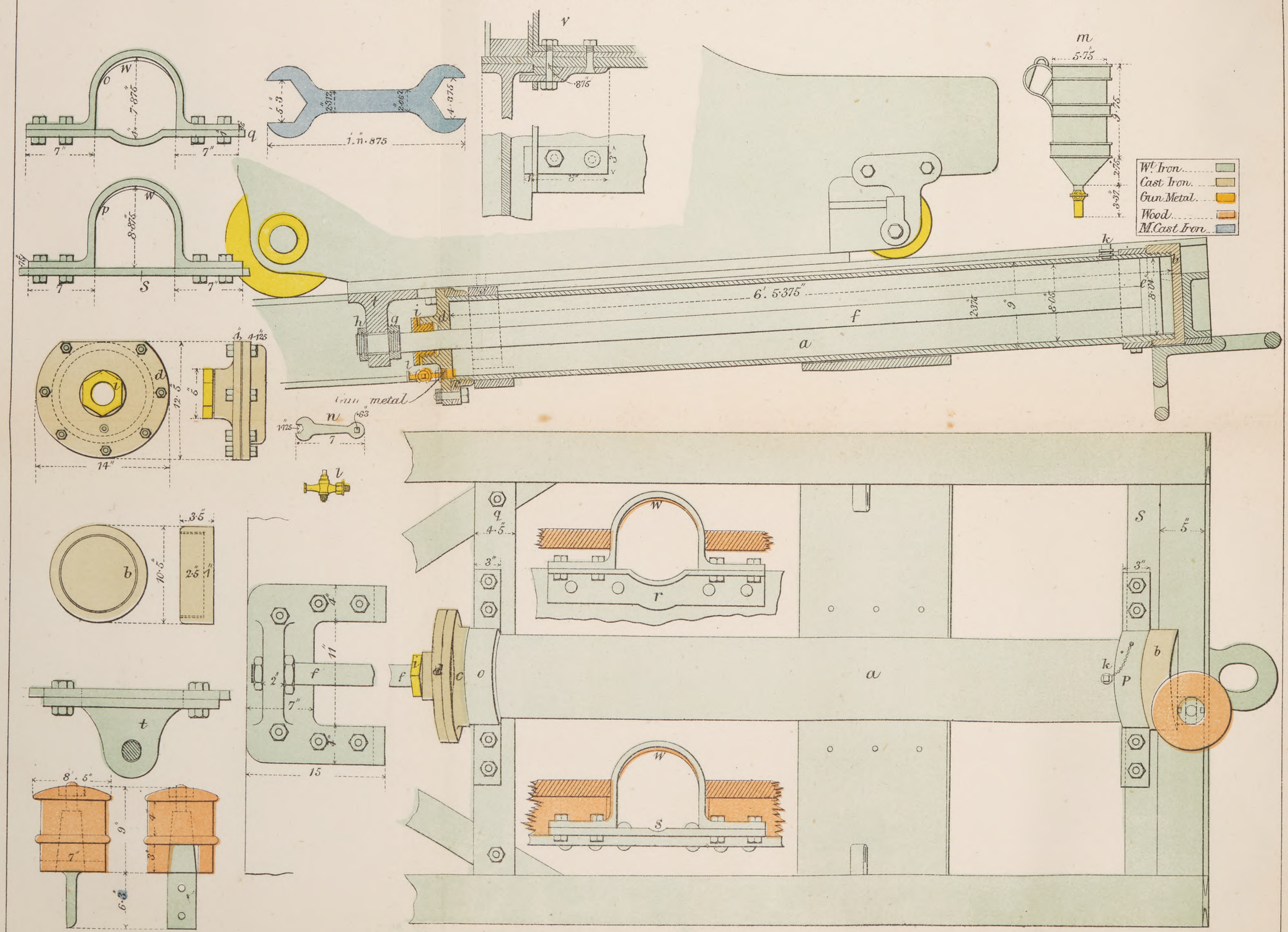
HYDRAULIC BUFFER FOR USE WITH HEAVY GUNS.



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can be dismounted from its slide the clips must be removed.

If a hydraulic buffer leaks at the gland, and the leakage cannot be stopped by tightening the latter, the packing must be renewed. Hydraulic buffers.

If the cover has at any time to be removed in replacing it, red or white lead may be used to make a close joint. In taking a buffer to pieces, the cap and flange should never be removed, nor the emptying cock from the cover.

During practice, the surfaces of the slide upon which the carriage slides should occasionally be slightly oiled to prevent seizure between the carriage and slide, and to ensure uniformity in the action of the buffer. This is especially necessary in dry frosty weather and with the heavier guns.

Compressor plates and bars should on no account be oiled. A little superficial rust on them is not detrimental, but much rust is inconvenient, as for the same amount of compression by the levers, it varies the amount of recoil; in fact, the recoil may be one round very little and the next very great. If bars become so rusted they should be scraped. Compressor.

The compressor bars and plates should be kept free from oil or grease.

HYDRAULIC BUFFER (See Plate XV.)

Use.

The buffers are intended to control the recoil sufficiently to prevent serious damage should the gun be fired without the compressors being set up; they are, consequently, supplementary to the compressors, and are used in conjunction with them. The amount of compression to be given to the compressors should be obtained by trial, and carefully noted, but in any case very little compression is required.

On emergency, any lubricating oil can be used in the buffer in lieu of service oil.

Parts.

The hydraulic buffer comprises the following parts and fittings:— Plate XV.

a. Cylinder.
b. Cap.
c. Flange.

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d. Cover.
e. Piston.
f. Piston rod.
g. Piston rod collar nut.
h. Piston rod connecting nut.
i. Packing gland.
k. Filling hole screw plug.
l. Emptying cock.
m. Graduated measure.
n. Spanner for plug and cock.
n. Ditto gland.
o. Front holding down band.
p. Rear „ „
q. Front bearing plate.
r. Front bearing angle plate.
s. Rear bearing plate.
w. Leather packing band.
t. Piston rod bracket.
v. Clips.

These fittings differ with different slides.

Connecting the Buffer to the Platform.

Placing in position.

Place the buffer, complete with its piston rod, &c., on the front and rear supporting plates, and observe that the cap *b* bears fairly against the rear transom; the screw plug hole should be on the top, and especial care taken that the straight part of the front cover is parallel to the bottom of the carriage, to enable the latter to recoil free of it; when thus adjusted, the front and rear bands are secured. The leather packings *w* are placed between the bands and the cylinder to prevent the latter turning.

Connecting the Carriage to the Buffer.

Connection with carriage.

Move the carriage to the rear sufficiently to enable a man to get at the bracket on the bottom plate, remove the connecting nut from the piston rod, and draw the latter forward until its end projects through the hole in the bracket, observing that it is quite central in this hole, having the same amount of clearance all round it; screw on the connecting nut, and when quite tight take half a turn back to ensure a play of the bracket between the two nuts.

Before connecting to the carriage, the rod should be pushed in and out to see that it works freely, and that the packing gland is not too tight.

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Hydraulic Buffers for 12-inch Slides, "Belleisle" Type.

Each slide is fitted with two 6-inch buffers fixed in the rear of the slide in the ordinary way.

To prepare the Buffers for use.

For 12-inch slides.

Run the carriage forward against the stops; remove the plugs from the filling holes in the top of the buffers; fill each buffer with oil, and draw off a measure full (8 qts. 1½ pts.) from each through the "run off cock" under the buffer, and replace the plugs in the filling holes.

Should it be necessary to increase the quantity of oil in the buffers through leakage or any other cause, the buffers should be filled, and 8 quarts 1½ pints drawn from each as above described, in order that the working quantity may be strictly preserved.

	qts.	pts.
Quantity of oil to fill each buffer with rods run out - - -	31	1½
Quantity to be drawn off - -	8	1½
Working quantity - -	23	0

Diameter of piston holes - 0·45 inches.

Hydraulic Buffers for 11-inch Slides, "Témeraire" Class.

For 11-inch slides.

Each slide is fitted with two 4-inch buffers, attached to the front of the slide and arranged for the rods, which are attached to the carriage, to be drawn outwards towards the rear on recoil.

To prepare the Buffers for use.

Run the carriage forward against the stops, take off the nuts of piston rods, and run the carriage back to the rear stops, without moving the piston rods. Remove the plugs from the filling holes in the top of the buffers, fill each buffer with oil, and draw off a quantity sufficient to fill the "draw-off measure" from each through the "run-off cock" at the side of the slide. Replace the filling hole plugs, run the carriage forward carefully so as to pass the ends of the piston rods through the brackets on the rear of the carriage, and replace the nuts.

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Should it be necessary to increase the quantity of oil in the buffers through leakage or any other cause, the buffers should be filled, and a quart drawn from each as described above, in order that the proper quantity for use might be strictly preserved.

	qts.	pts.
Quantity of oil to fill each buffer with rod run in - - - -	9	1
Quantity to be drawn off - -	1	0
Working quantity -	8	1
Diameter of piston holes -	0·3 inches.	

Hydraulic Buffers for 10-inch Slides (except for Gun Boats).

For 10-inch slides.

Each slide is fitted with two 6-in. buffers fixed in the rear of the slide in the ordinary way.

To prepare the Buffers for use.

Run the carriage forward against the stops; remove the plugs from the filling holes in the top of the buffers; fill each buffer with oil and draw off a quantity sufficient to fill the "draw-off measure"* from each through the "run-off cock" under the buffer, and replace the plugs in the filling holes.

Should it be necessary to increase the quantity of oil in the buffers through leakage or any other cause, the buffers should be filled and a measure full be drawn from each as above described, in order that the proper quantity for use might be strictly preserved.

	Broadside. Qts.	Pts.	Revolving. Qts.	Pts.
Quantity of oil to fill each buffer with rods run out -	30	1½	28	0½
*Quantity to be drawn off -	8	1½	7	0½
Working quantity -	22	0	21	0
Diameter of piston holes -	0·6 inches.		0·57 inches.	

Hydraulic Buffers for 10-inch Gun-boat Slides.

For 10-inch gun-boat slides.

Each carriage is fitted with two 4-inch buffers attached to the front and rear transoms and arranged for the rods, which are attached to the slide, being drawn outwards on recoil.

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To prepare the Buffers for use.

Run the carriage forward to the front stops.

Remove the plugs from the filling holes in the top of the buffers, fill each buffer with oil and draw off a quantity sufficient to fill the "draw-off measure"* from each through the "run-off cock" at the front of the carriage, and replace the filling hole plugs.

Should it be necessary to increase the quantity of oil in the buffers through leakage or any other cause, the buffers should be filled and 1¼ pints drawn from each as described above, in order that the working quantity may be strictly preserved.

	Qts.	Pts.
Quantity of oil to fill each buffer with rod run in - - -	10	0¼
*Quantity to be drawn off - -	0	1¼
Working quantity - -	9	1

Diameter of piston holes - 0·275 inches.

Hydraulic Buffer for 7-inch 90-cwt. Slides.

For 90-cwt. slides.

Each slide is fitted with two 4-inch buffers fixed in the rear of the slide in the ordinary way.

To prepare the Buffers for use.

Run the carriage forward against the stops; remove the plugs from the filling holes in the top of the buffers; fill each buffer with oil and draw off a measure full from each through the "run-off cock" under the buffer, and replace the plugs in the filling holes.

Should it be necessary to increase the quantity of oil in the buffers through leakage or any other cause, the buffers should be filled and 3 qts. 0¼ pt. be drawn from each as above described, in order that the proper quantity for use might be strictly preserved.

	Qts.	Pts.
Quantity of oil to fill each buffer with rods run out - - -	8	1¼
Quantity to be drawn off - -	3	0¼
Working quantity - -	5	1

Diameter of piston holes - - 0·35 inches.

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The Hydraulic Buffers applied to the 64-pr. R.M.L. Carriages and Slides, Marks IV., V., and VI.

Each carriage is fitted with one hydraulic buffer four inches internal diameter, the piston rod is in tension during recoil, and is secured to the front of the slide.

The buffer is attached to the carriage by two collars, which allow the carriage to slide along it, but which, during recoil, are prevented moving by jointed bars on both sides, attached to the front collar and to the buffer.

Guide bars on the slide prevent the joints coming into play during recoil, but for housing the gun, allow the bars to double together and the carriage to slip backwards, the buffer remaining stationary.

To prepare the Buffer for use.

Run the carriage forward to the front stops.

Remove the filling plug in the top of the buffer, fill the buffer with oil, and draw off sufficient to fill the "draw-off measure"* through the run-off valve under the buffer in the front cap, and replace the filling-hole plug.

Should it be necessary to add oil to the buffer, to replace loss by leakage, the buffer should first be filled and then a measure full drawn off as described above, in order that the correct working quantity may be strictly preserved.

	Marks IV. and V.	Mark VI.
Quantity of oil to fill each buffer with the rod run in -	7⅜ qts.	8⅜ qts.
*Quantity to be drawn off -	1¼ pts.	1¼ pts.
Working quantity -	6¾ qts.	7¾ qts.
Diameter of (3) piston holes -	0·38 inches.	0·414 inches.

On an emergency any lubricating oil may be used in lieu of the service oil.

Hydraulic Buffers for 20-pr. B.L. Gun Vessel and 20-pr. B.L. upper-deck Slides.

For 20-pr. slides.

Each slide is fitted with one 4-inch buffer fixed in the rear of the slide in the ordinary way.

To prepare the Buffer for use.

Run the carriage back against the rear stops; remove the plug from the filling hole in the top of the buffer; fill the

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buffer with oil and draw a measure full* through the "run-off cock" under the buffer and replace the plug in the filling hole.

Should it be necessary to increase the quantity of oil in the buffer through leakage or any other cause, the buffer should be filled and $1\frac{1}{4}$ pints be drawn off as above described in order that the working quantity for use may be strictly preserved.

	Qts.	Pts.
Quantity of oil to fill the buffer with the rod run in	5	$1\frac{1}{4}$
*Quantity to be drawn off	0	$1\frac{1}{4}$
Working quantity	5	0

Diameter of piston holes - 0·47 inches.

Hydraulic Buffers for Boat Service.

(*These instructions to be placed in Boat's Magazine.*)

For boats slides.

1. When oil is not procurable for the management of hydraulic buffers for boat service, water may be used, either wholly or to make up any deficiency of oil. In the former case a little soft soap or washing soda added to the water is desirable.

2. The oil will endure very low temperatures, but should water only be used, great care will be taken in seeing that it is in a fluid state before firing.

3. If procurable, methylated spirits may be added to the water in the proportion of one part of spirit to two parts of water; it will then resist low temperatures fairly well.

4. Care will be taken to follow the directions for filling which are engraved on each buffer.

VAVASSEUR MOUNTINGS.

Plate XVI.

The following instructions for Vavasseur's mountings refer more particularly to the 6-inch central pivot mountings of H.M.S. "Canada" and "Cordelia;" but those parts referring to the cylinders, compressor running-out and by-pass valves, elevating gear, and running out gear are generally applicable to all Vavasseur's mountings which have them.

In the 5-inch and smaller mountings, the running-out and by-pass valves are not considered necessary; the cylinders are

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filled through a filling hole in each cylinder, one hole being used for filling, and the other as an air outlet. The carriage should be run in and out by tackles to make certain that the cylinders are full.

Service Instructions and Notes on Working.

Compressor.

Plates XVI., and XVII.

The two cylinders B.B′ are to be kept filled with liquid, the total quantity required being about 4 gallons. Service buffer oil, or water may be used, but we prefer oil. The liquid should be filtered through the strainer provided before passing into cylinders.

To fill Cylinders.

Gun to be in firing position:—

Plates XVI. and XVII.

1. Remove air-hole plug B^4 from left-hand cylinder.
2. Unscrew plug O of valve box on right-hand cylinder. Screw lifting rod with eye into top of running-out valve K, Fig. 6, and lift the valve out of the box.
3. Screw funnel with strainer into top of valve box and fill the cylinders to $\frac{1}{2}$-inch above valve seat.
4. Replace valve and plug of valve box, and finally the air-hole plug in L.H. cylinder. To insure cylinders being full, gun should be run in and out once by means of screw.

To empty Cylinders.

Plates XVI. and XVII.

1. Remove air-hole plug B^4 from L.H. cylinder, and plug O and valve K from R.H. cylinder.
2. Remove emptying plugs B^5 at front end of cylinder.

Note.—These plugs not being at the lowest point of the cylinders, a small quantity of liquid will remain in each, which can, however, be almost wholly got out by running gun in and out.

Regulation of Compressor.

The adjustment of pistons and valves is fixed to give a recoil of about 19 inches with all charges and any angle of elevation.

The orifices in piston are full open at commencement of recoil, and are nearly closed by the valve at the end of recoil.

The drawing, Plate XVII., Fig. 5, shows the orifices in L.H. piston and valve. Those of R.H. piston are similar but shallower.

The length of recoil is best measured by putting a grummet of string around the elevating shaft E^{13}, Plate XVI.,

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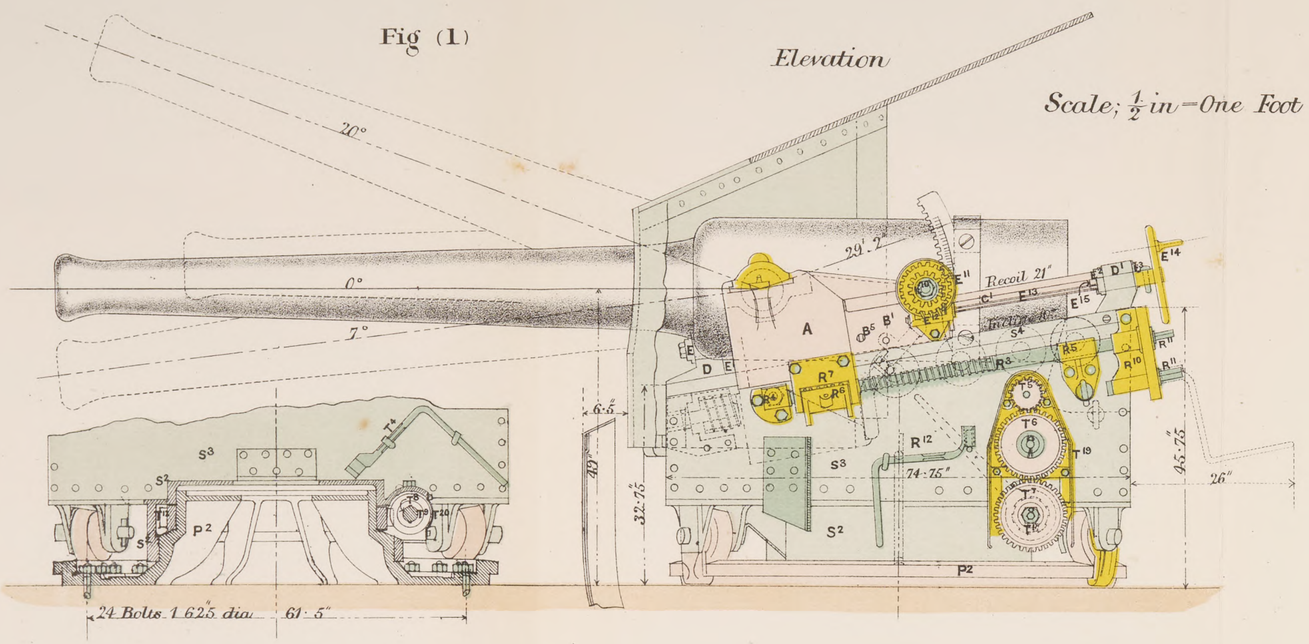
Central Pivot Vavasseur Mounting for 6″ 81 Cwt Mark II. and 6″ 89 Cwt Mark III. B.L. Gun.

Fig (1)



Longitudinal Section of Pivot and Base Plates.

Fig (2)

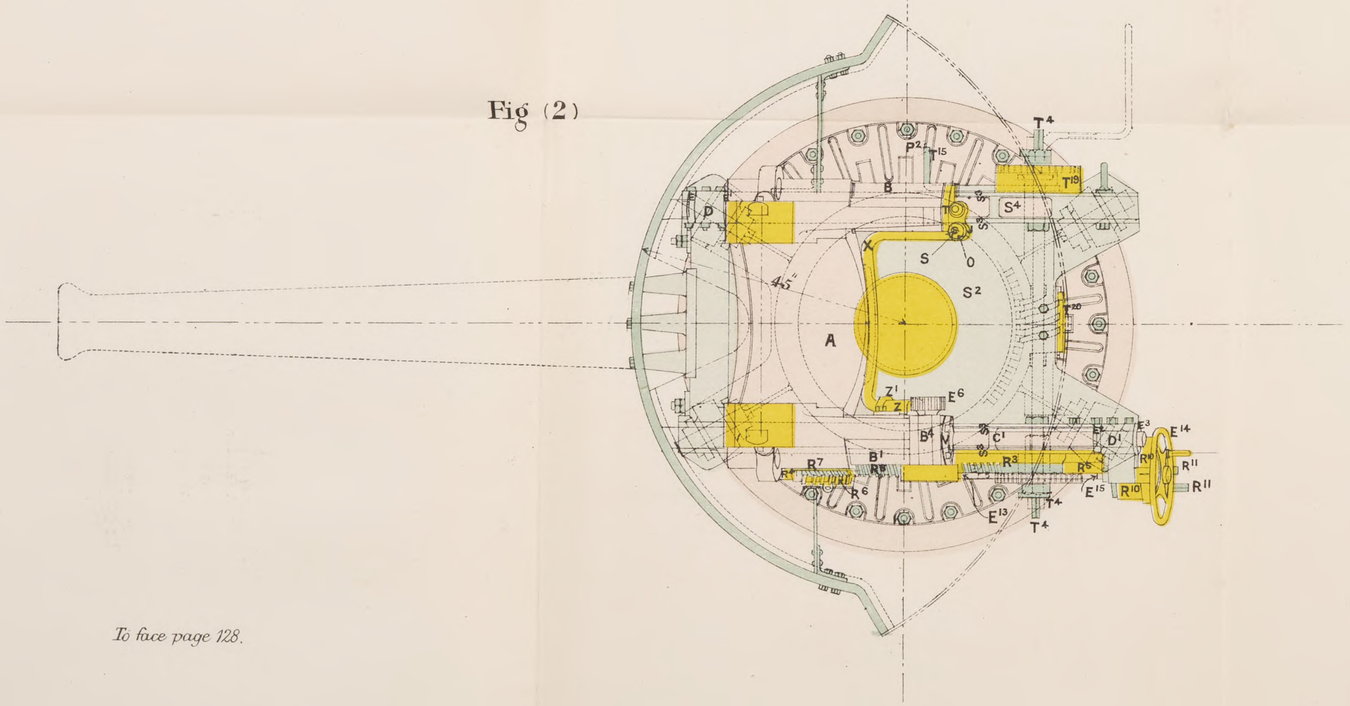
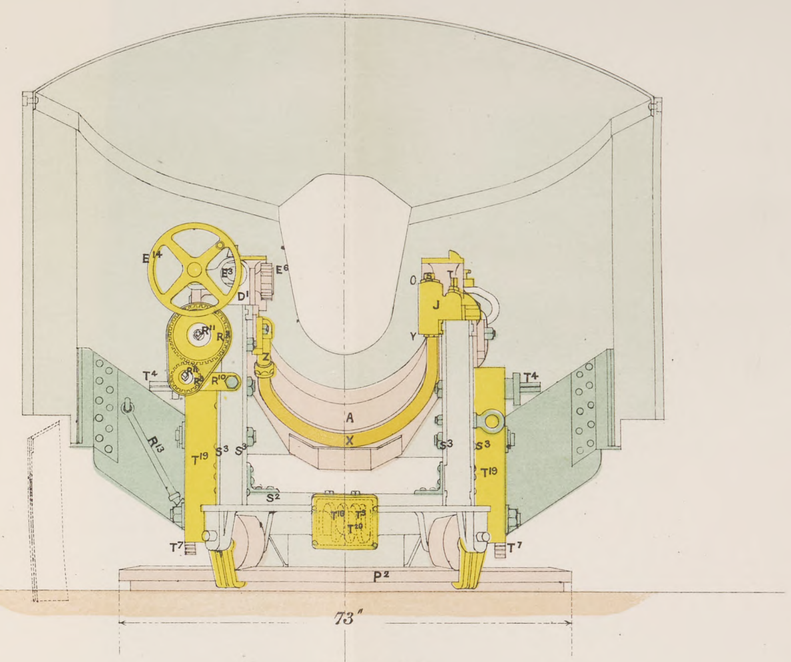


Fig (3)



Rear End View

Rate of Elevating — One turn of handle — 1°·14
„ „ Training — „ „ „ „ — 2°·37

	Cwt	qr	lbs
Weight of Carriage	21	0	0
„ „ Slide	56	3	6
„ „ Pivot Plate	26	3	23
Total	104	3	1
„ „ Shield 1·25″ thick	28	0	9

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VAVASSEUR 6″ MOUNTINGS.

DRAWING EXPLANATORY OF SERVICE INSTRUCTIONS FOR COMPRESSOR.

Fig (4)

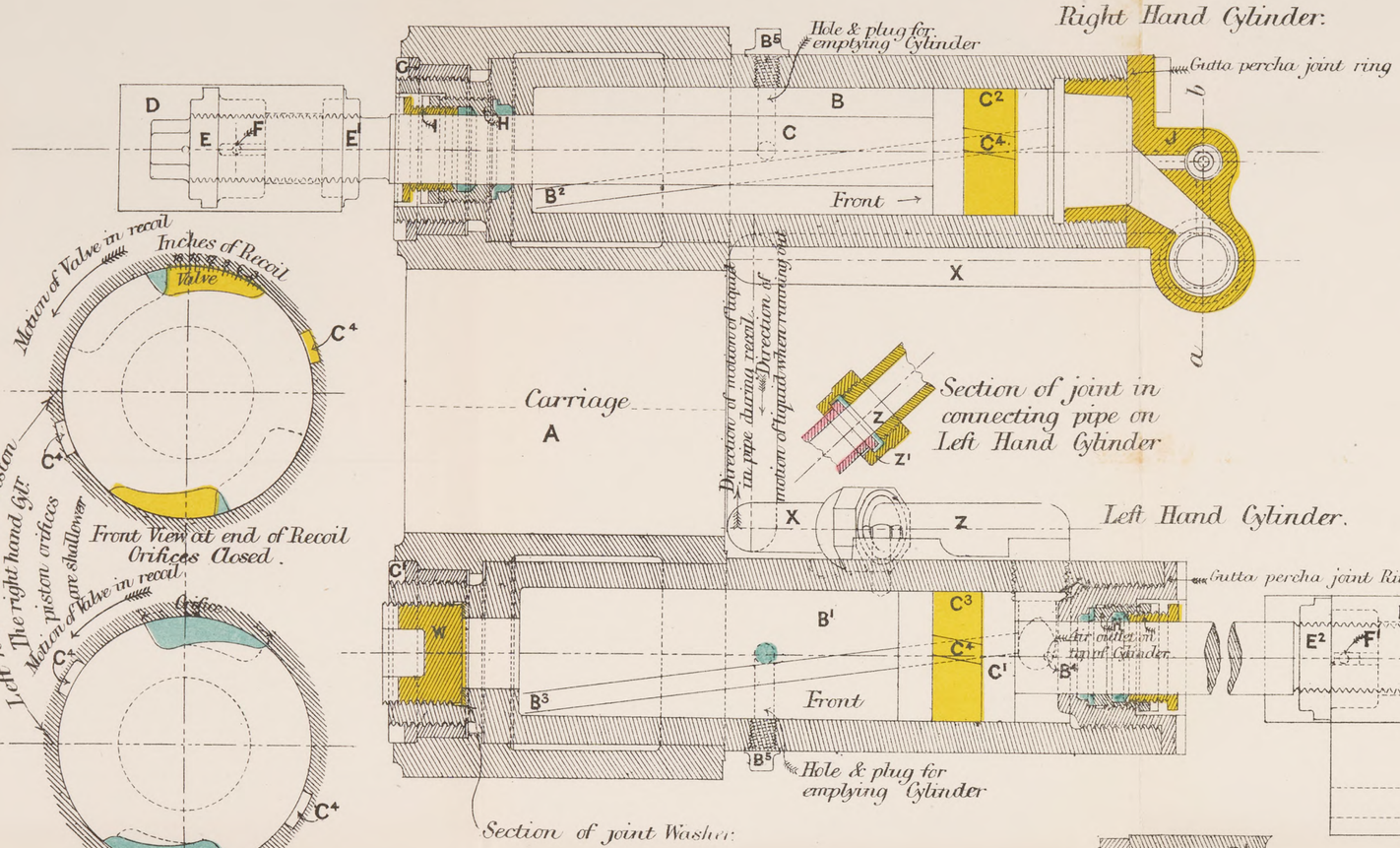

Right Hand Cylinder.
Hole & plug for emptying Cylinder
Gutta percha joint ring
Front →
Carriage
A
Direction of motion of liquid in pipe during recoil.
Direction of motion of liquid when running out.
Section of joint in connecting pipe on Left Hand Cylinder
Left Hand Cylinder.
Gutta percha joint Ring.
Front
Hole & plug for emptying Cylinder
Section of joint Washer.

Fig (5.)

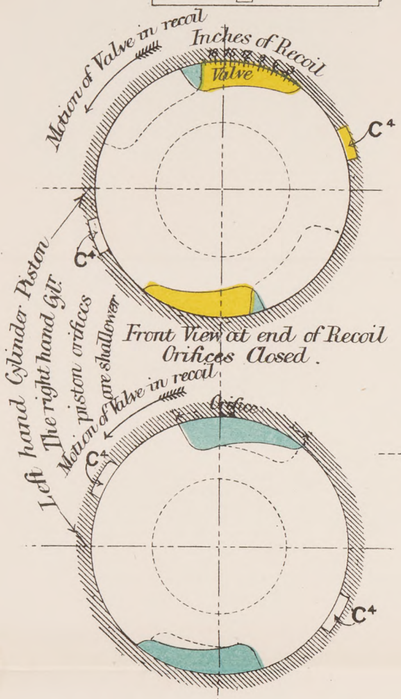
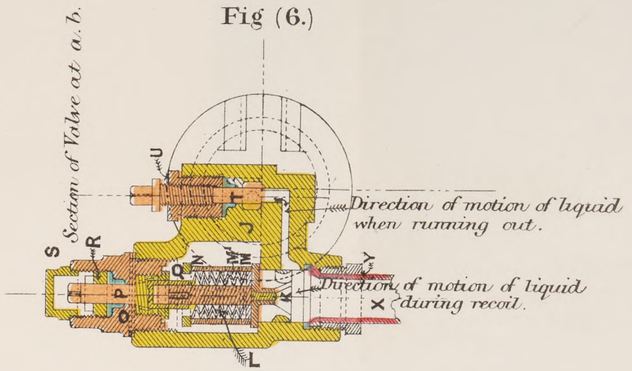

Left hand Cylinder Piston
The right hand Gtr
piston orifices
Motion of Valve in recoil
Inches of Recoil
Valve
Front View at end of Recoil Orifices Closed.
Orifice
Front View at commencement of recoil. Orifices open.

Fig (6.)


Section of Valve at a. b.
Direction of motion of liquid when running out.
Direction of motion of liquid during recoil.
Scale 2″—1 Foot

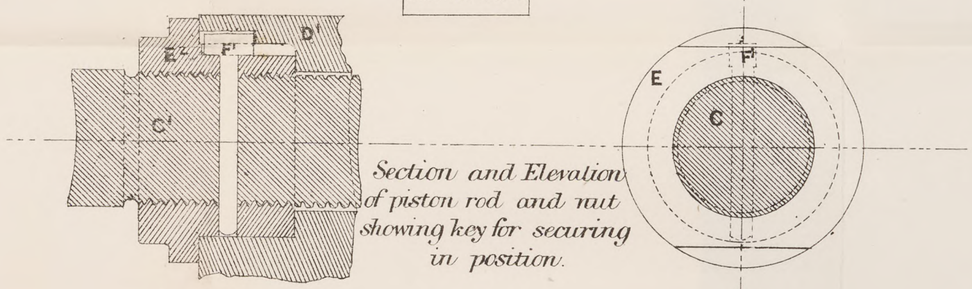


Fig (7.)

Note; The letters of reference on this plate apply to the 6 inch broadside as well as the central pivot mountings.

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Fig. 1, near the elevating bracket, the latter in recoil will drive the string before it leaving it on the shaft at the point denoting end of recoil. A grove E^{15}, Plate XVI., Fig. 1, on the elevating shaft gives the extreme recoil.

Running-out Valve K. Plate XVII., Fig. 6.

This acts automatically during recoil, being raised by the flow of liquid from the left to the right hand cylinder. It is loaded by a spring L, the pressure from which can be regulated thus:—

1. Remove the centre cap S on valve box, and turn the adjusting screw P in the required direction.

NOTE.—Increased pressure on this valve is sometimes necessary to prevent mounting running in when ship is rolling.

The adjustment of the spring is limited by a stop Q, so that the valve cannot be prevented from lifting on recoil.

By-pass Valve T. Plate XVII., Fig. 6.

On running out the flow of liquid being from the right to the left hand cylinder tends to keep the large valve closed, and to avoid the necessity of raising it for running out, a smaller or by-pass valve T is arranged so that the liquid can flow. By keeping the by-pass closed, the carriage will remain in at the end of recoil, or by opening it more or less the rate of running out can be moderated as desired.

Elevating Gear. Plates XVI. and XVIII.

This is arranged to allow the gun to be fired while being elevated.

The gear is worked from the rear hand-wheel E^{14} through a worm and wheel gearing E^{12}, E^{11}, the latter being connected to the elevating pinion E^{6} by a series of friction-plates E^{7}, E^{8}. These have a sufficient grip to allow the gun to be elevated, but will slip and avoid breakage of gear in case of shock when gun is fired. On the 4-inch and 5-inch Mark I. carriages the worm wheel of the elevating gear is fitted with two steel cones, which, being tightened by a nut, answer the same purpose as the friction plates on the 6-inch. The 5-inch, Mark II., is fitted with friction plates similar to the 6-inch.

To adjust the friction of Elevating Gear.

1. Run the gun to extreme depression.
2. Screw up the nut E^{10} against worm-wheel E^{11} until one man at the muzzle can just raise the gun.

* NOTE.—In later pattern carriages the friction plates have been replaced by a friction cone, with an adjusting nut and set screw.

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Before gun is mounted the paint must be scraped off the trunnion arms, and burrs, if any, removed to ensure its turning freely in the trunnion bearings, and consequent easier working of elevating gear.

In order that carriage may run easily on the slide, it is recommended before exercising or firing to rub the surface of slide against which carriage rubs and underneath the clip plates with tallow.

Training Gear. Plates XVI. and XVIII.

The gun can be fired while being trained.

The gear is worked on either or both sides of the slide. The power passes from the handle T^4 through a train of three spur wheels T^5, T^6, T^7, to the worm T^9, T^{10}, gearing into the wheel T^{12} fixed on the pivot plate.

To take up any backlash in the thread of the worm, the latter is divided into two parts, T^9, T^{10}, the space between which can be adjusted by means of the nut T^{13} on the screwed bush T^{14} at the R.H. side of slide. The outside of the nut has eight notches, and a lever T^{15} is fitted on it having a tongue which can be engaged in any one of the notches.

By lifting up the lever in the direction of the arrow, the nut T^{13} is pressed against the web of the wheel T^7, and this bearing against the nut T^{17} draws the worm shaft outwards, carrying with it the half-worm T^{10}, the thread of which is thus pressed against one side of the teeth on the wheel T^{12}, and the other half-worm T^9 by the reaction of the pressure against the slide is pressed against the opposite side of the teeth.

When the lever is up hard the mounting will be secured against any movement while at sea.

In case of wear the lever can always be brought into a convenient position for tightening the gear by shifting the tongue into a suitable notch on the nut T^{13}.

The travel of clamping lever is 39 inches, and the most convenient position is about $\frac{2}{3}$ rise from stop for commencement of clamping.

Both parts of the worm are driven by the key T^{18} on the shaft T^8, but the shaft is free to slide in the half-worm T^9. The other half-worm T^{10} is tight on the shaft.

The box T^{20}, in which the training worm T^9, T^{10} works, should be kept filled with tallow.

*Should the training gear be difficult to work it will probably be found that the clamping nut T^{13} is rubbing

* Added at request of Messrs. Vavasseur & Co. (*see* G. 1538–83).

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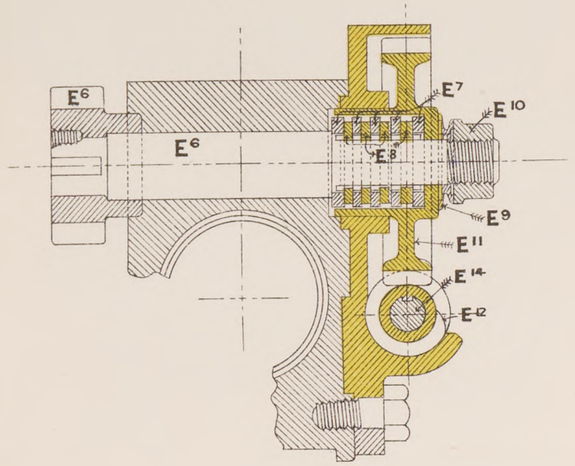
VAVASSEUR 6″ MOUNTINGS.

DRAWING EXPLANATORY OF SERVICE INSTRUCTIONS FOR ELEVATING & TRAINING GEAR.

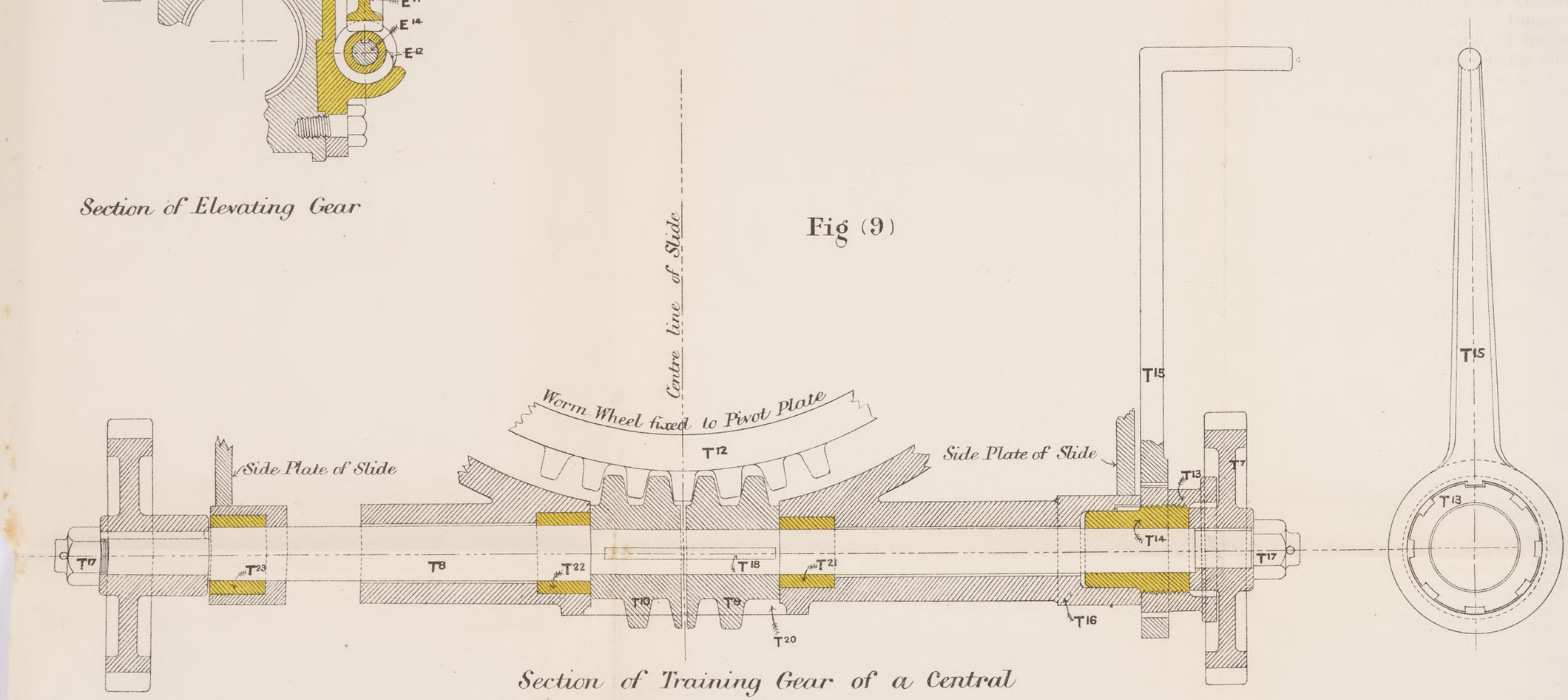
Fig (8)



Section of Elevating Gear

Scale; 2″ — 1 Foot.

Fig (9)



Section of Training Gear of a Central Pivot Mounting.

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against the wheel T^7. When the lever is down the nut T^{14} should be quite free and not bearing against the wheel.

The training wheel of the 6-inch broadside mountings is supplemented by a trailing wheel, which can be adjusted by means of a nut to take up the backlash on the rack.

6-Inch Mountings.

To dismount Carriage. Plates XVI. and XVII.

Partially empty the cylinders as directed, then—

*1. Remove running-in wheels R^8, R^9.
*2. „ guard for wheel R^{10}.
†3. „ rear bracket R^5 for running-in screw.
†4. „ running-in screw R^3.
5. „ elevating wheel E^{14}, and run the shaft forward.
6. „ rear nut E^3 in L.H. rod, and press piston into cylinder.
7. „ rear bracket D′ by taking out its bolts and raising it clear of the stop key at top of slide.
8. Unscrew nut E^1 on R.H. rod sufficiently to allow piston rod to go forward and uncover the set pin F.
9. Take out set pin F.
10. Unscrew front nut E.

Note.—Not to attempt to unscrew the front nut until the pin F is taken out.

Dismount carriage by running off at rear, taking care to keep it level until clear of *both* sides of slide, as they are of unequal length.

To disconnect the Copper Pipe between the Cylinders. Plates XVI. and XVII.

1. Withdraw the coupling screw Y from the valve box end.
2. Unscrew the coupling nut Z^1 at L.H. end.
3. Take out the screw securing metal bend Z in position on L.H. cylinder.
4. Raise the free end of the metal bend Z until clear of the copper pipe.

Note.—The metal bend Z is screwed into L.H. cylinder, and the joint being made by a leather washer, this should be

* For "Canada" and "Cordelia" central pivot mountings only.
† For "Canada," "Cordelia," and broadside mountings only.

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renewed, if necessary, after unscrewing, so as as to bring the bend tight on the seat in the direction to suit connexion to pipe, that is, when the hole in lug is opposite screw hole in cylinder.

On the 6 inch broadside slide the gun must be dismounted, the clip on the bottom plate unbolted, the coupling nuts Y, Z′, unscrewed, and the valve casing turned sufficiently to allow the pipe to clear.

To take out R.H. Piston. Plate XVII.

1. Remove connecting pipe X.
2. Unscrew the valve casing J. The carriage must be run in to do this.
3. Remove nuts on rod as directed for dismounting carriage.
4. Slacken or remove gland nuts H.I.
5. Take out piston at rear end.

To take out L.H. Piston. Plates XVI. and XVII.

1. Remove elevating wheel E^{14}.
2. „ rear nut E^{3}.
3. „ rear bracket D^{1} as previously directed.
4. „ or slacken gland nuts H^{1}, I^{1}.
5. Unscrew plug V from cylinder.

To remove Cylinders from the Carriage Body.

Empty them as much as possible, and disconnect pipe X.

For R.H. Cylinder. Plate XVII.

1. Disconnect and remove piston and rod as directed.
2. Take out gland screws H.I.
3. Unscrew nut G.
4. Drive cylinder back by striking on a piece of hard wood at the front end.*

For L.H. Cylinder. Plates XVI. and XVII.

If gun is mounted take off the arc.
1. Disconnect piston rod as directed.
2. Remove elevating wheel E^{14} and run the shaft forward.
3. Unscrew nut G^{1}.
4. Drive cylinder back as directed for R.H. cylinder.

* For "Canada" and "Cordelia" central pivot mountings only.

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To dismount Training Gear. Plates XVI. and XVIII.

1. Remove covers for gear T^{19}.
2. „ intermediate wheels T^{6}.
3. „ nut T^{17} on R.H. side.
4. „ wheel T^{7} on R.H. side.
5. „ lever T^{15} with bush T^{14}.
6. „ shaft by tapping out to L.H. side.
7. For broadside mountings:—Remove the cap and withdraw the pedestal.

To remove Carriage Rollers from Slide.

1. Remove the bar covering heads of roller pins screwed to inside of slide.
2. Screw the lifting rod into hole tapped in a roller.
3. Drive out roller pin to the inside of slide.
4. Lift roller out of slide.
5. For broadside mountings:—Remove the metal bearings and drive the roller pins out from outside of slide.

To remove Slide Rollers.

1. Wedge up slide under the roller brackets so as just to take the weight.
2. Remove roller pins.
3. „ rollers.

References to Drawings.

General drawing.
Section of compressor. Fig. (4). *Plate XVII.*
„ elevating gear. Fig. (8). *Plate XVIII.*
„ training gear. Fig. (9). *Plate XVIII.*

References to Slide and Pivot Plate.

Figs. 1, 2, and 3. *Plate XVI.*

S^{2} Base of slide. Cast steel.
S^{3} Side plates of slide. Steel.
S^{4} Rollers for carriage fitted in top of slide.
P^{2} Pivot plate. Cast steel.

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References to Compressor.

Figs. 1, 2, 3, 4, 6, 7. *Plates XVI. and XVII.*

A	Carriage. Cast steel.
B B^1	Right and left hand cylinders. Wrought steel.
B^2 B^3	Rifle grooves in cylinders.
B^4	Air-hole in L.H. cylinder with plug.
B^5	Empting plugs.
C C^1	Pistons and rods. Wrought steel.
C C^2	Valves rotating. Metal.
C^4	Tongues on valves working in rifle groove B^2, B^3.
D	Attachment of R.H. piston rod to slide.
E E^1	Nuts securing R.H. piston rod to slide.
F	Key securing R.H. piston rod in position
D^1	Attachment of L.H. piston rod to slide.
E^2 E^3	Nuts securing L.H. piston rod to slide.
F^1	Key securing L.H. piston rod in position
G G^1	Nuts connecting cylinders to carriage.
H H^1	Screw gland inner on piston rod for leather flange ring packing.
I I^1	Screw gland outer for plaited cotton packing.
J	Casing for running out valve with gutta-percha joint ring.
K	Running out valve.
L	Spring for running out valve in pairs of steel dished washers.
M	Spring box having holes, M^1.
N	Cap for spring box.
O	Plug for valve box.
P	Screw adjusting compression of spring.
Q	Screw limiting compression of spring and lift of valve.
R	Gland screw with leather flanged ring joint.
S	Cap covering screw.
T	By-pass valve.
U	Screw gland for by-pass valve with leather flanged ring packing.
V	Plug closing rear end L.H. cylinder with gutta-percha joint ring.
W	Plug front end L.H. cylinder with leather washer.
X	Connecting pipe.
Y	Screw connecting pipe to valve box with leather washer.

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Z Metal bend for pipe attached to L.H. cylinder.
Z^1 Nut connecting pipe to metal bend with leather washer.

References to Elevating Gear.

Figs. 1, 2, 3, 8. *Plates XVI. and XVIII.*

E^6 Pinion gearing into arc fixed on Spindle E^6.
E^7 Plates, friction steel, end ones 0·4 thick.
" " intermediate ones ·25 thick.
E^8 Plates, friction, ·4 thick. Metal.
E^9 Washer spring. Steel.
E^{10} Nut on spindle.
E^{11} Worm wheel.
E^{12} Worm.
E^{13} Elevating shaft forming spindle for worm.
E^{14} Hand wheel.
E^{15} Groove in elevating shaft showing point of extreme recoil, or point to which carriage can be run in.

References to Training Gear.

Figs. 1, 2, 3, 9. *Plates XVI. and XVIII.*

T^4 Training handles.
T^5 T^6 T^7 Spur wheels.
T^8 Worm shaft.
T^9 T^{10} Training worm in two parts.
T^{11} Screw connecting worm T^{10} to the shaft.
T^{12} Wheel fixed on pivot plate.
T^{13} Adjusting nut working in.
T^{14} Screwed bush.
T^{15} Adjusting lever.
T^{16} Boss on slide.
T^{17} Nuts on worm shaft.
T^{18} Key on worm shaft for worm.
T^{19} Covers for gear.
T^{20} Box for worm.
T^{21} ^{22} ^{23} Metal bearings for worm shaft.

References to Running in Gear.

Figs. 1, 2, 3. *Plate XVI.*

R^3 Running in screw.
R^4 Bracket carrying screw front end.
R^5 Bracket carrying screw rear end.
R^6 Falling nut.

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R^7	Bracket on carriage driving nut.
R^8 R^9	Spur wheels on screw.
R^{10}	Bracket carrying spur wheels.
R^{11}	Squares to take handles.
R^{12}	Handle for running in screw.
R^{13}	Lever for falling nut.

Care and Preservation.

The general instructions for care and preservation on page 120 will apply to the various Vavasseur mountings, but there are certain parts of the hydraulic buffer liable to leakage, which require special attention. As a rule, leakage from any part of the buffers may be remedied by tightening up the particular cap or gland where it occurs; if not, the packings must be examined, and if necessary renewed, according to the following instructions:—

1. Unscrew the nut E^1 (Plate XVII.), draw out the piston rod and remove the key F, unscrew the nut E; then push home the piston rod, and run the carriage back sufficiently to remove the nut E^1; unscrew the outer gland I, and then the inner gland H containing the cotton packing; withdraw the piston rod sufficiently to get at the leather packing, which can then be removed. The leather packing must be carefully examined, and, if damaged, the edges pared round; if irrepairable, it must be removed. In either case it must be well tallowed. Repack the stuffing box with cotton saturated with tallow, and replace the glands and nuts by reversing the above process.
2. Unscrew the nut E^3, push the rod home and remove the key F^1; then unscrew the nut E^2, and run the carriage back sufficiently to remove it. The packing is then examined as described in paragraph 1.
3. The gutta-percha rings are renewed by unscrewing the valve casing J or plug J^1. The nut Y must be unscrewed before removing the casing J; particular attention must be paid, in replacing the casing, to set it exactly in its former position, otherwise it will foul the gun.
4. The leather packing in the running out valve K can be removed by taking off the cap S and unscrewing the gland R; on the by-pass valve T by unscrewing the gland V, and on the connecting pipe by unscrewing the nuts Y, Z^1. In 4-inch and 5-inch

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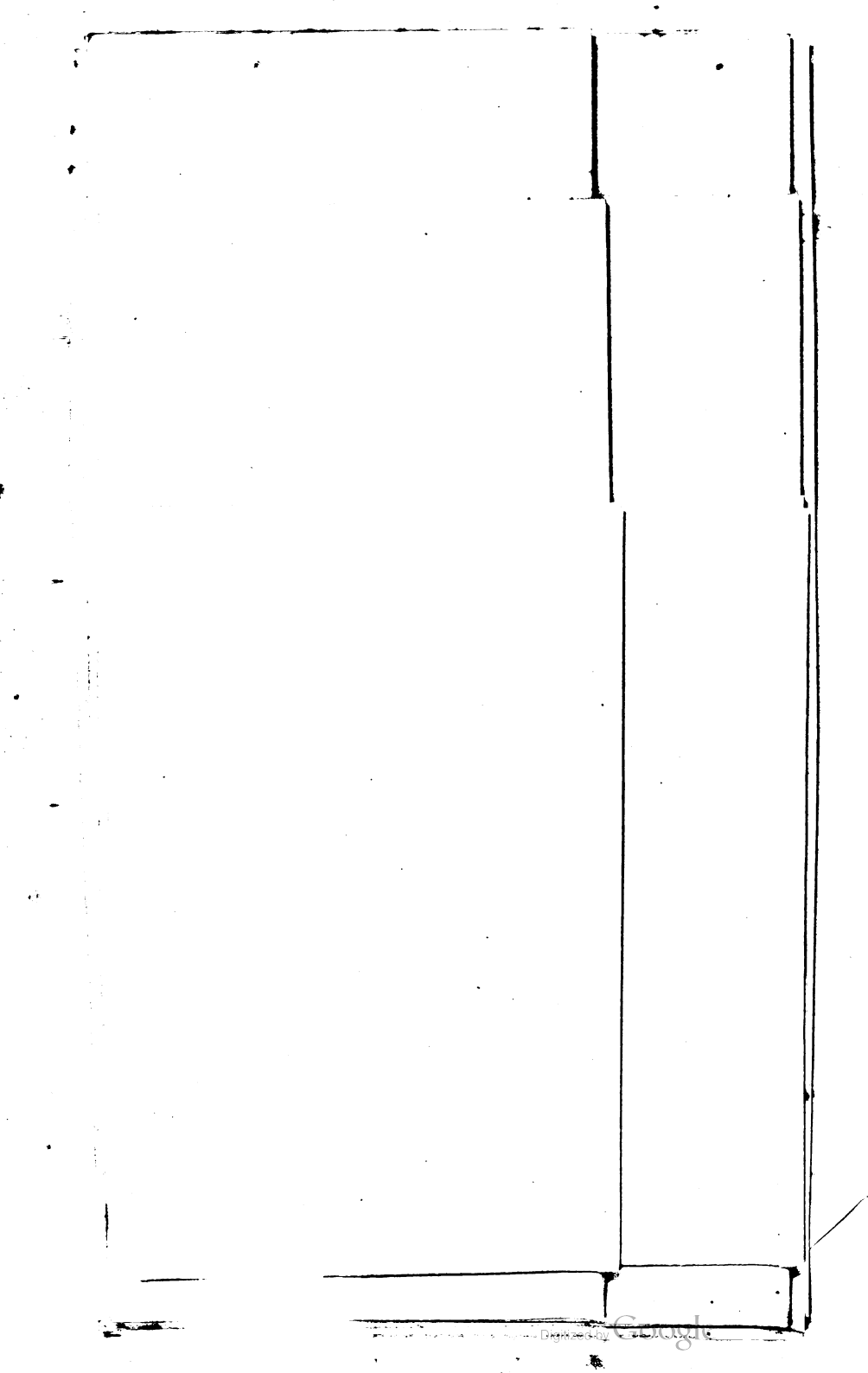
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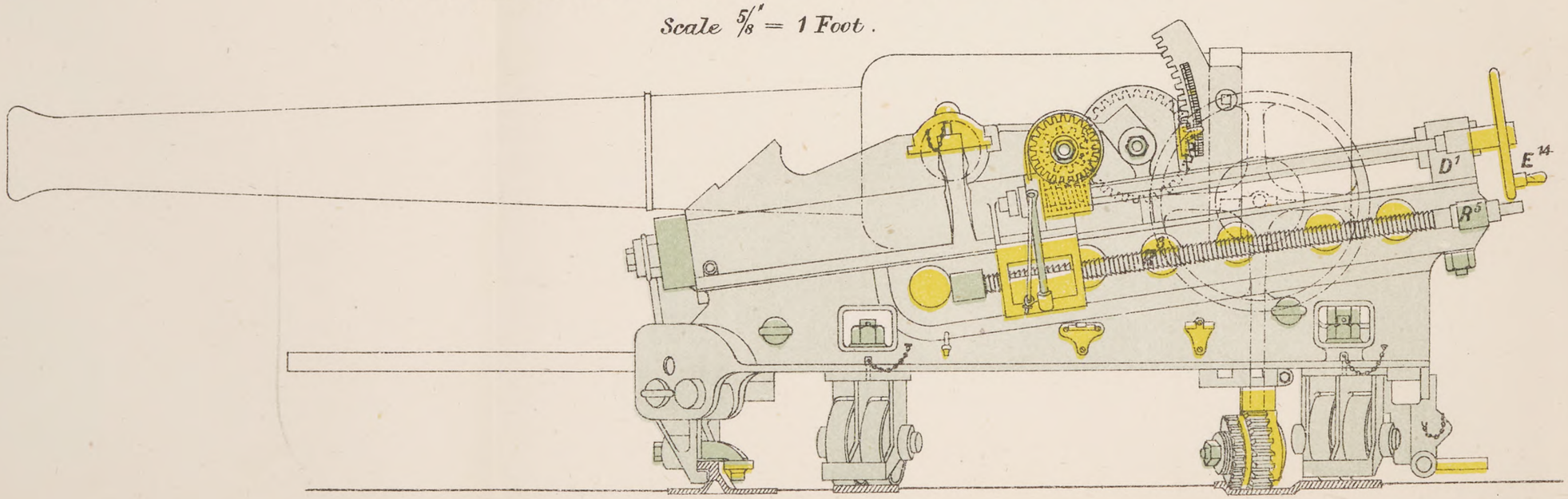
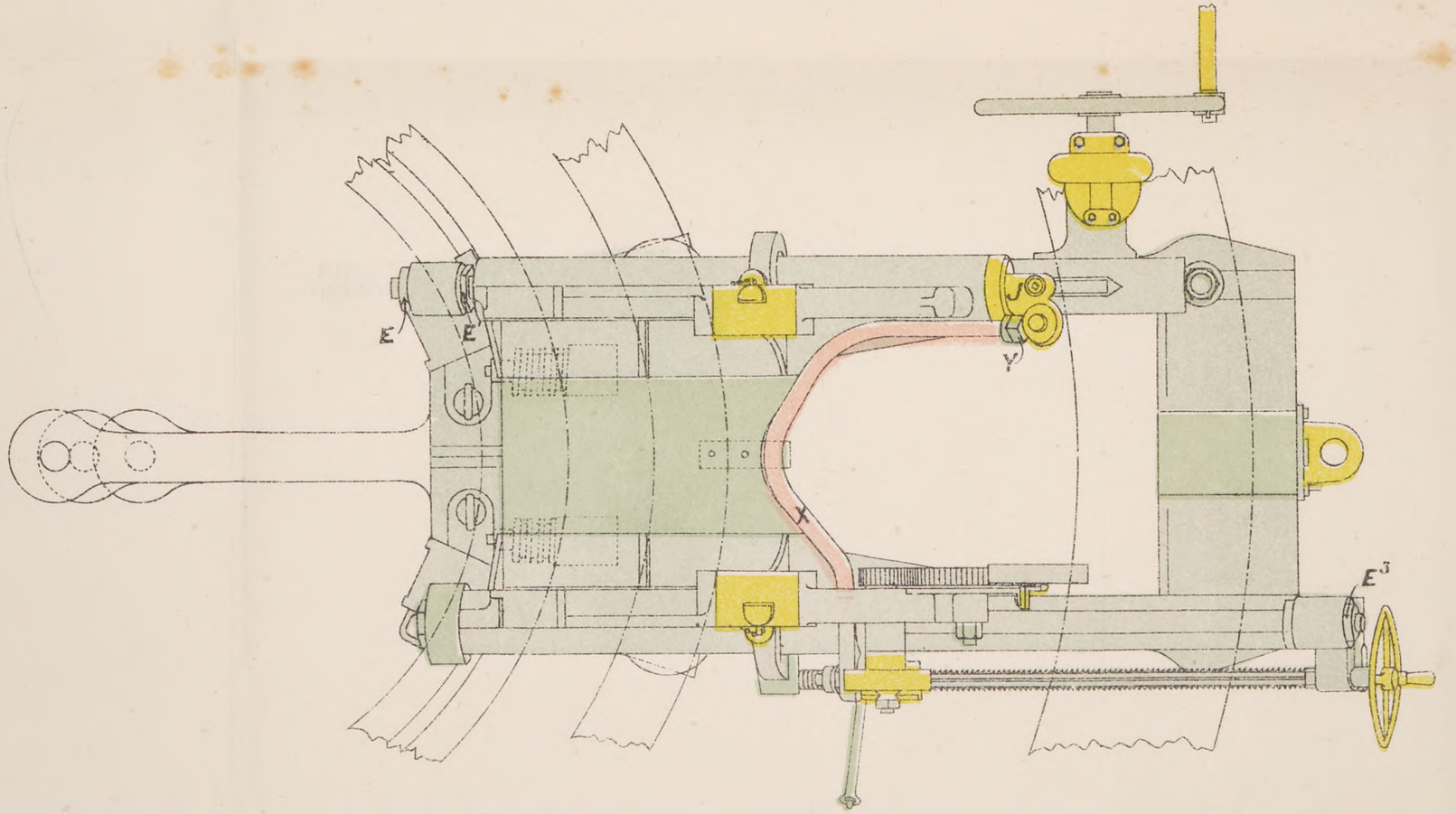
CARRIAGE, NAVAL, VAVASSEUR. B.L.6-INCH, BROADSIDE. MARK I.
SLIDE. VAVASSEUR. B.L. 6-INCH. BROADSIDE MARK I.

Scale $\frac{5}{8}'' = 1$ Foot.





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mountings, before the packings can be examined, the nuts must be unscrewed from the piston rods, the piston rods pushed home in the cylinder, and the carriage run back the necessary distance to allow of the glands being removed.

The glands and packing are attended to in a similar manner to that described for the 6-inch mountings.

6″ Broadside Mountings. *Plate XX.*

For instructions as to adjustment of valves for length of recoil, *see* Plate XIX.

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CHAPTER VI.

GAS-CHECKS AND FUZES.

Fixing Gas-Checks.

1.—*Projectiles fitted with Plug and Nut.*

1. Unscrew the nut and remove it, then apply the "wrench, removing base plugs" to the gas-check plug, and screw it well up in the direction of the arrow* to ensure its being well home.

2. When unscrewing the nut, if there is any tendency for the plug to unscrew also, the "wrench, removing base plugs" should be at once applied to the head of the plug, and turned in the direction of the arrow at the same time as the nut is being turned in the opposite direction.

3. Place the gas-check on the base of the projectile, with the concave, or unpainted side, next the base, then screw the nut on to the end of the plug with the "spanner, gas-check nuts." With Mark I., gas-check, plug and nut, the nut must bind against the gas-check. With Mark II., gas-check, plug and nut, the nut will be screwed down to the shoulder on the plug.

2.—*Projectiles fitted with Plug with Hexagonal Head.*

4. Unscrew the plug and remove it.

5. Place the gas-check on the base of the projectile with the concave, or unpainted side, next the base (the saucer-shaped gas-checks for 6·3-inch howitzer with the concave surface to the rear), insert the plug and screw it well home with the spanner until it binds against the gas-check.

6. With gas-checks having projections for studded projectile, see that the projections are in the line of the studs before screwing the plug home; with the 6·3-inch howitzer shells, see that the radial projections on the gas-checks fit into the corresponding grooves in the base, before screwing the plug home.

3.—*Projectiles fitted for "Gas-checks rotating," without Plugs.*

7. These gas-checks are automatic, and become fixed to the projectile when the gun is fired, with the smaller natures

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* The heads of the gas-check plugs, and the wrought-iron nuts, will each be stamped with an arrow to show the direction in which to turn, either when screwing in the gas-check plug, or when screwing on the wrought-iron nut.

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of ordnance, or when it is required to attach the gas-check before loading, place the gas-check on the base and strike it with a pointed hammer or chisel so as to make an indent at two or three points in that part which surrounds the neck of the projecting base of the projectile.

Fixing Plugs and Fuzes.

When plugs, primers, or metal fuzes are screwed into shells they should be lubricated with Field's grease, No. 3. Prevention of corrosion.

Palliser and other projectiles fitted with plugs and kept in exposed situations. where the plugs are liable to become set fast by corrosion from the action of salt water, or otherwise, should have their plugs unscrewed once at least every six months, and the screws cleaned and re-lubricated as above.

The "key, iron, fuze, and plug, G.S." and the "key, iron, plug, G.S." are the only implements which should be used for screwing in the G.S. plug. Implements.

Distinguishing Marks of Wood Fuzes. *Plate XXI.*

The 15 sec. M.L. wood time fuze has a scale printed on white paper, covering the greater portion of the body and has a black head. The paper scale is marked spirally from 1 to 30, in half-tenths of fuze, corresponding to $\frac{1}{4}$ sec. times of flight. Wood fuzes.

The 15 sec. with the detonator wood time fuze is similar to the M.L. fuze, except the arrangements in the head. It is slightly longer, and has a brass safety pin to which is attached a piece of blue braid.

Preparing Fuzes.

Fuzes, Wood Time. Plate XXI.

These fuzes are prepared for any desired range by boring through the side-hole corresponding to the required length into the composition.

When using the hook-borer place the fuze in the hook, in the proper position for boring the required hole, enter the bit into the side hole, screwing up until the bit has entered as far as the borer will allow, taking care not to press upon the fuze so as to prevent its bedding fairly in the hook. Use of hook-borer.

Unscrew, and when the bit is quite clear remove the fuze from the hook. The length of the bit is so regulated that,

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when placed in the handle, it will enter sufficiently far into the composition when screwed down to the shoulder. If the bit should become unserviceable the handle must be detached from the shank and the tightening screw unscrewed, the square hole in the hook being made for that purpose. Care must be taken when substituting another bit that it is properly placed in the handle, *and that the tightening screw firmly presses upon it, for if any space be left between the handle and the head of the bit the end will not enter a sufficient depth into the composition.* The borer should be occasionally examined and cleaned. The operation of preparing the fuze and fixing it in the shell takes, on an average, about 15 seconds; with a little practice these operations may be performed in a shorter time.

Fuzes, E. Time. Plate XXII.

E. time.

These fuzes are prepared for the desired range after they have been screwed into the shell.

Loosen the nut with the key, so as to free the collar. Hold the shell in the right hand and move the collar with the forefinger and thumb of the left hand until the arrow points to the required length of fuze, then screw up the nut with the right hand, steadying the collar at the same time with the left hand, finally, tighten the nut with the key. Should the fuze be taken from the shell, the collar must be set at the "blank" before it is returned.

Fixing Fuzes.

Fuzes, Wood Time, M.L. Plate XXI.

Wood Time Fuzes are always to be fixed in the fuze hole by screwing in by hand and are never to be struck on any pretence whatever.

Fixing wood fuzes.

These fuzes are fixed in the fuze hole by screwing the fuze round by hand until it is held firmly in the fuze hole, the fuze must not be uncapped until the shell is placed in the muzzle of the gun. These fuzes are "uncapped" by taking hold of the small end of the copper band, which is left exposed, and unwinding from left to right smartly, so as to thoroughly detach the band from the head of the fuze and to leave the priming fully exposed.

Wood time fuzes may be bored into at any hole, irrespective of the projectile and gun in which they are used.

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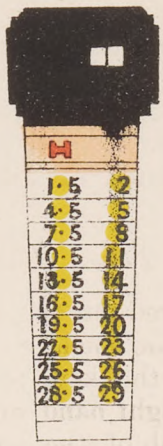
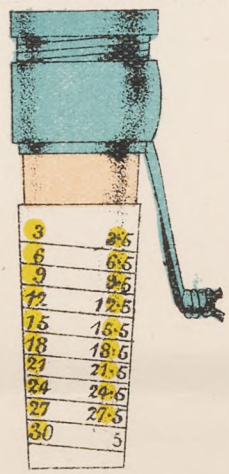
15 SEC WOOD TIME FUZE. M. L.

15 SEC



15 SEC WOOD TIME FUZE WITH DETONATOR.

15 SEC WITH DETONATOR.



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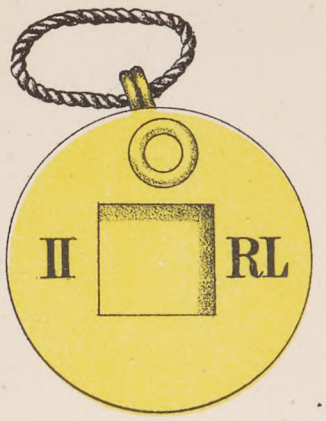
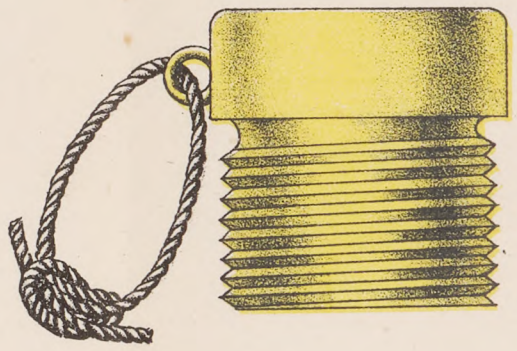
METAL FUZES.

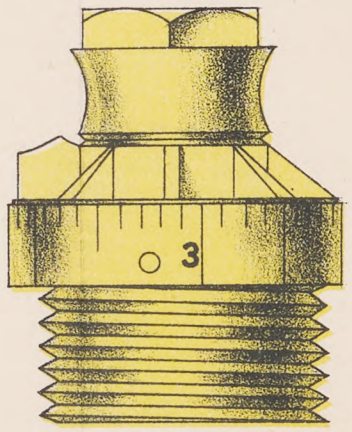
PETTMAN'S
GENERAL SERVICE.



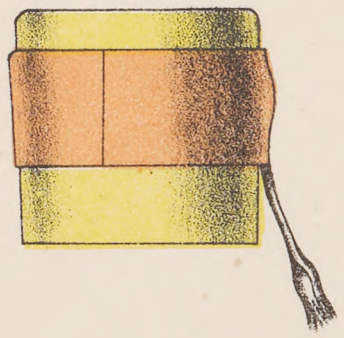
R.L. PERCUSSION.



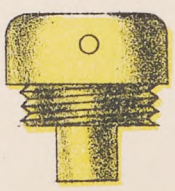
E TIME FUZE.

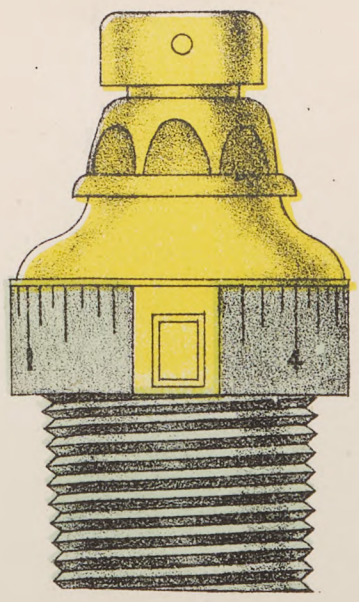


PERCUSSION PLAIN B.L.



E.O.C. TIME & CONCUSSION.





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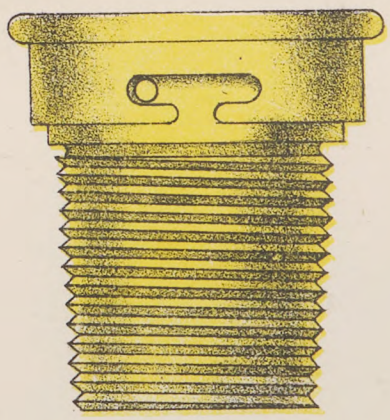

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Fuzes, Wood Time, B.L. Plate XXI.*

These fuzes should be screwed into the fuze hole by hand, when they cannot be screwed any further they are properly secured. *These fuzes must not be fixed by striking them with a mallet or any other instrument, neither must they be struck against anything.* With R.B.L. guns the safety pin is not to be withdrawn until just before entering the shell into the breech. B.L. wood fuzes.

With R.M.L. guns the safety pin is not to be withdrawn until after entering the shell into the muzzle.

Fuzes, E. Time. Plate XXII.

These fuzes are screwed firmly down with the Armstrong key, the serge plug having been first removed and a B.L. plain fuze inserted. E. time. Plate

Fuzes, Percussion, B.L. Plain. Plate XXII.

These fuzes are used in the R.B.L. segment shells, 20-pr., 12-pr., and 9-pr.; they require no preparation except the removal of the safety-pin, which is to be taken out just before dropping the fuze into the shell; care must be taken to insert it properly; the part with the rim round it is the top of the fuze; it should be firmly held in its place by the fuze hole plug, or the E. time fuze, whichever may be used, being screwed tightly down on to it. B.L. percussion. Plate XXII.

Fuzes, Percussion, Pettman, G.S. Plate XXII.

These fuzes require no preparation,—they are simply screwed firmly into the fuze hole by means of the "key, iron, fuze and plug, G.S." and a wad with loop placed over the fuze and cemented down. Pettman, G.S. Plate XXII.

Should there be any difficulty in extracting a percussion fuze, the shell should either be fired as it is, or thrown overboard.

Fuzes, Percussion, R.L. Plate XXII.

These fuzes require no preparation except the removal of the safety pin,—they are screwed firmly into the fuze hole by means of the "key, iron, plug, G.S." R.L. percussion. Plate XXII.

With R.B.L. guns the safety pin is *not* to be removed until just before entering the shell into the breech.

With R.M.L. guns the safety pin is not to be withdrawn until after entering the shell into the muzzle.

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* Including 15 second fuze with detonator.

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Wad, Papier Mâché, in Fuze Hole.

Wad. When fixing fuzes in shells having a wad in the fuze hole, it is not necessary to remove the wad, as the explosion of the fuze is sufficient to force it into the shell, if using percussion fuzes; and, if using wood time fuzes, the wad is driven into the shell in the operation of fixing the fuze.

Fuzes, E.O.C. Time and Concussion. Plate XXII.

The fuze consists externally of two parts—which are packed separately—the fuze proper, and the thimble by which it is ignited.

Plate XXII. The fuze is provided with a metal nut which clamps a metal collar on to the cylindrical portion (the body) of the fuze, which is of white metal; round this latter is marked the scale in inches and tenths, and in it is a hole for the key used to screw the fuze into the shell, or remove it.

The shell is fuzed as follows:—

(*a.*) The fuze, without the thimble, is tightly screwed into the fuze-hole by means of a special key, somewhat similar to the "key, iron, shell and fuze, Armstrong's," before the shell is brought to the gun.

(*b.*) The metal nut is unscrewed a little by hand or key, to loosen the metal collar, which is turned until the arrow head on it is opposite the desired mark on the scale.

(*c.*) The nut is now tightened to keep the collar in this position.

(*d.*) The thimble *must not be* screwed into the top of the fuze until the moment of loading.

All the screws above mentioned are right-handed.

If desired that the concussion arrangement alone acts, the arrow or the collar must be set midway between the zero point of the graduation and the extreme length of fuze composition. *Great care must be taken that it is not set too near the zero in order to avoid "prematures."*

Great care should be taken after the thimble is inserted, that the shell is not dropped, particularly on its base.

Fuze, Percussion, Direct Action. Plate XXII.

Plate XXII. Suitable for use in guns firing reduced charges, and in guns firing full charges for direct impact, or to act on graze, provided angle of elevation is 10° or upwards.

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The metal cap is fitted for the "key, iron, G.S. fuze and plug;" it is fastened on head of fuze by a bayonet joint.

The fuze requires no preparation beyond the removal of the metal cap, which should be done after shell is placed in bore of M.L. guns, or just before being entered into breech of B.L. guns.

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